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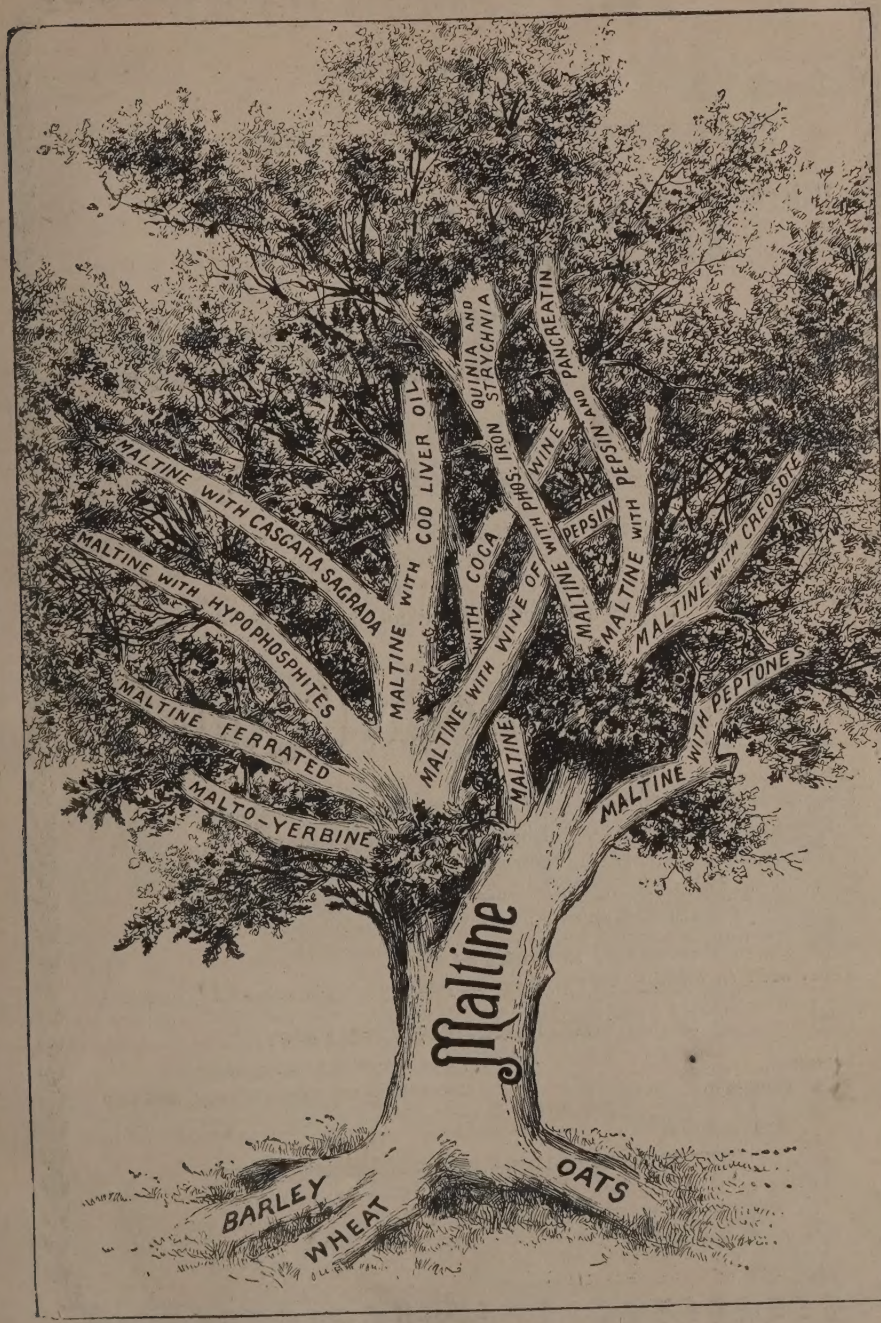
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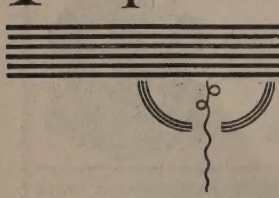

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An era is fast approaching, when no writer will be read and appreciated by the great majority, save and except those who can effect that for bales of manuscript, that the hydrostatic screw performs for bales of Cotton by condensing that matter into a period that before occupied a page.—COLTON.

ORIGINAL COMMUNICATIONS.

A CRITICAL SURVEY AS TO THE ETIOLOGY AND TRANSMISSION OF MALARIAL FEVERS THROUGH INFECTION BY MOSQUITOS.

BY EDWARD NICHOLAS LIELL, M.D,

Jacksonville, Fla.

Formerly Lecturer on Diseases of Women, New York Polyclinic, and Gynecologist to St. Elizabeth Hospital, New York.

The part played by mosquitos in the transmission of malarial fevers is one occupying the scientist and physician of to-day, both as to etiology and prophylaxis. That the mosquito bears a causal relation to the propagation of malarial fevers and that it is the chief and direct factor as to etiology seems to-day almost beyond question. Every essential step in the experimental proof has apparently been obtained, and it is virtually accepted by scientific men in general. A bare possibility, through future investigations, may determine that the human malarial parasites may develop in other hosts, but cumulative evidence tends strongly to support the assertions, admitting of but little question, that the genus anopheles mosquito is the dominating factor and source of malarial infection and transmission.

In her role of transmittor of disease the mosquito is proven to be a deadly enemy to the human race, and the problem of the etiology of malarial fever is therefore drawing nearer and nearer to its final solution. In tropical and sub-tropical countries the victims of malarial fever are numbered by thousands. That science has not succeeded in devising means to check or stamp out a disease so inimical to the human race is due not only to obscurity attending its etiology but to the fact that up to the present day the habits, habitats and

distribution of the various kinds of mosquitos have been but little known by entomologists. Theoretically, it had been suggested and advocated by numerous writers, as embodied in the excellent review by Nuttall, in the Centralblatt fur Bakteriologie, February and March, 1899.

The present scientific interest in support of the mosquito-malarial theory dates from the researches of Manson in 1894, and subsequently in his Gulstonian Lectures in 1896. The first experimental evidence in support of his hypothetical conjecture that "as mosquitos remove from the human body filaria nocturna and in turn act as host to this parasite, so also may musquitos remove and service the purpose of host to the malarial parasite," was that forthcoming, by direct observation, through Surgeon-Major Ronald Ross, of the Indian Medical Service, in 1896, who allowed mosquitos to feed on the blood of a patient containing the crescent form of the œstivo-autumnal parasite ; when the stomachs of these mosquitos were subsequently examined, a development of the parasites into spheres and flagellated forms were noticed, fully forty per cent. of the crescents developing later into flagellates.

The next advancement made was by Bignami, also in 1896, who, after a critical analysis and rejection of the claims of the air and water theories of malarial transmission, reached the conclusion that "direct inoculation of malarial fever in man was by the stick of the mosquito," malarial fever behaving itself with regard to man as if the malarial germs were inoculated by mosquitos. In the British Medical Journal, December 18th, 1897, Ross makes mention of his discovery of pigmented malarial organisms in the stomach-wall of the grey or "dapple-winged" mosquito, the latter being of the species anopheles claviger. He also dissected numerous specimens of culex inoculated with malarial blood, and in every case but one failed to find a single plasmodium ; concluding, in the exceptional case, the presence of an avian parasite, a proteosoma infection. Continuing his experiments in 1898, Ross offered a complete demonstration of the mosquito-malarial theory, as applied to birds, succeeding in carrying proteosoma from birds to mosquitos and from mosquitos back to birds again, expressing his belief at this time that what he had found true of proteosoma of birds would be found true of human malaria.

Other Italian investigators, Grassi and Dionisi, about this time made known their researches, illustrating from sections and dissections, the cycle of mutations observed in the mosquito in each of the several types of malarial infection.

The first experimental demonstration and scientific fact of the production of malarial fever in man through inoculation from the bites of mosquitos, was that of Bignami in 1898. While pursuing his investigations his attention was attracted to an article by Grassi, showing that in Italy and Sicily, though mosquitos were abundant in places free from malarial fever, certain known species were absent,

being found only in places where malarial fever was active. Finding three species of mosquito—Anopheles claviger, Culex penicillaris Rondani, and Culex Malariæ Grassi—exclusively associated with malarial localities, Grassi assumed that these were the malarial-bearing species. The subject of Bignami's experiment was a man who had never had malarial fever; the mosquitos, the three varieties referred to, being obtained from Maccarese, a malarial locality. Subjected to their bites at frequent intervals, in a room by itself in the hospital for several weeks, the patient finally developed a chill and fever, the temperature remaining elevated until the administration of quinine several days later. Microscopical examination of the blood showed numerous hyaline, pigmented and intra-corpuscular œstivo-autumnal parasites. In his varied experiments Bignami made clear the fact that blood rich in parasites and impregnated with quinine was incapable of reproducing malarial fever when injected into a healthy subject. Subsequently, other successful inoculation experiments were reported by these Italian scientists, including Bastianelli. In one, where eleven mosquitos—six culex pipiens, one anopheles nigripes and four anopheles claviger—were collected from a room occupied by four persons, all apparently suffering from œstivo-autumnal malarial fever; in only two—anopheles claviger—was found in the stomach-wall, Ross' coccidia containing pigment granules. They furthermore asserted that 75 per cent. of anopheles claviger, caught in rooms occupied by people having malarial fever, were found to contain the parasite, while control mosquitos were negative. Again, these observers allowed three anopheles, ten days after they had fed upon a patient whose blood contained crescents, to bite a healthy person in whom, after an incubation period of about twelve days, a severe infection developed. The mosquitos were then examined and sporozoits were found in their salivary glands. From the fact that the Italian investigators have lately reported the development of both œstivo-autumnal and tertian parasites in anopheles bifurcatus as in anopheles claviger, they believe it will in all probability be shown that all the Italian species of anopheles may act as host to the organisms.

The researches of Bignami and Bastianelli emanate from their laboratories at the Hospital Santo Spirito, Rome, where, it is stated, are to be seen not only mounted specimens showing the morphology of the malarial parasite through its entire life history, but also interesting slides showing the parasite in the stomach-walls of the anopheles claviger, and the sporulation of the organism and the fecundation of the female. Their method of staining the specimens to demonstrate the structure of the organism is one of methylene blue and eosin.

While in New York City, in October last, Dr. Jeffries, bacteriologist to the New York Polyclinic, kindly offered me the courtesy of the laboratory in connection with my study and observation of the malarial organism, demonstrating the staining process and the grad-

ual and varied changes associated with the development of the organism in blood taken from malarial fever patients. Slides of the œstivo-autumnal, tertian and quartan were in evidence.

In the Kameroon, Ziemann has for some time been collecting evidence bearing upon the mosquito theory, and after the investigation and sectioning of thirteen different species of mosquito, a variety of anopheles was finally found which gave positive results. Thirty per cent. of this species, caught and obtained from a malarial-infected locality contained, in their stomach-walls, malarial coccidia of various degrees of development, corresponding closely to those described by the Italian observers; those which had not imbibed any of the crescent forms, obtaining merely the blood, failed to develop the coccidia. The importance of this is shown in that, in Kameroon as elsewhere, the parasite of so-called tropical fever is metamorphosed into a coccidia-like body in whose interior the sporozoites subsequently develop.

The researches of Dr. C. J. Finlay have shown, regarding transmission of infection, that after an interval of two or three days, the time required to digest the blood and empty themselves, they are in condition to sting the next victim that offers, which process may be continued as many as ten or twelve times during the thirty or more days he has been able to keep such mosquitos alive. Furthermore, with temperature below 25° C. (77° F.), the time required by the culex mosquito to digest the blood and get ready for another bite is prolonged to several days; and the pupœ of that species, if kept at temperatures below 23° C. give five males to one female, whereas at 25°–30° C. the proportions are reversed, the females being more numerous.

One of the essential conditions is that the transmitting mosquito should itself experience a true infection, which, though not endangering its life and disturbing the physiological functions but little, requires a pathogenous susceptibility for the specific germ or germs which it is called upon to transmit. It is the object of the female mosquito to find at hand victims from whom it can draw the warm life-blood apparently required, not so much for its own nourishment as for the purpose of ovulation and for the reproduction of its species.

Experiments have been undertaken the past summer in the Roman Campagna, through the London School of Tropical Medicine, by Drs. Sanborn and Low, with their attendants. These investigators lived for several months in the malarial valley near Ostia, in a wooden hut, protected from mosquito invasion by netting and wire screens in doors and windows; they went about by day, remaining scrupulously within doors between sunset and sunrise; they not only drank the water but exposed themselves to the night air, taking no quinine. While there was a general prevalence of malarial fever in those about them, they remained entirely free of infection, thus rendering confirmatory and conclusive evidence of the mosquito theory. Con-

sidering the mode of life of peasants of the Pontine marshes, and in a country where the mosquito is rampant and the average hygienic conditions bad, abundant opportunities present themselves for the study of malarial infection in all its manifestations.

The experience of the members of the Liverpool Expedition sent to Nigeria, West Africa, as reported by Dr. Elliott, a member of the expedition, is shown in that, despite exposure for four months in intensely malarial localities, the simple employment of mosquito nets —no quinine being taken—prevented any member from contracting malarial fever.

The experiment of inoculating malarial fever in England by mosquitos fed on the blood of malarial fever patients in Rome, has recently proved successful. According to the Journal of Tropical Medicine, Sept., 1900, three batches of anopheles were, at Dr. Manson's request, fed in Rome by Dr. Bastianelli, on three separate malarials (tertian), and forwarded in cages to the London School of Tropical Medicine. As a compliment to his father's researches, Mr. P. T. Manson, strong and healthy and who had not resided in a malarial locality since childhood, volunteered as a subject for experiment, submitting upon three separate occasions to the bites of these mosquitos. A few days following the third inoculation, characteristic symptoms of tertian malarial fever appeared, the presence of the corresponding parasites being found in the blood several days thereafter.

These observations, so recently recorded and verified by several competent observers, apparently removes the last vestige as to any doubt played by the mosquito as intermediate host and as the direct transmittor of malarial fever.

Dr. W. A. Thayer, of Baltimore, in a paper read before the Philadelphia County Medical Society the past summer, discussed the question as to whether it is through the agency of the mosquito only that the infection is acquired by man. Reasoning from the knowledge of other infectious diseases, and the fact that it is the only proved agency, he believes it unlikely that there is more than one method of infection, the exclusive mosquito theory explaining most of the conditions associated with malarial fever.

In a bulletin just issued by the Department of Agriculture at Washington, prepared by Dr. L. O. Howard, only about thirty of the two hundred and fifty known varieties of mosquito have been found in the United States. As to varied modes of distribution he states that, since the opening up of the gold fields in Alaska and the great influx of miners and traders, knowledge of the abundance and ferocity of the Alaskan mosquito has become widespread. Furthermore, there is a constant carriage inland from the marshy coast of very many mosquitos, the railway trains proving to be the most important mode of conveyance. In this way even mountain resorts will obtain their supply of mosquitos, and with the improvement of

railway service and the increase in the number of through cars the danger is constantly increasing.

Regarding the morphology of the malarial organism, Dr. James Ewing, in a discussion on malaria before the New York Academy of Medicine, described minutely, with the aid of lantern slides, the changes observed in the life-history of the organism—its three principal types: tertian, quartan and œstivo-autumnal. The flagellate forms of the parasite develop from round bodies, derivatives from crescentic forms. It has been shown that if a certain variety of mosquito was fed on the blood of a person having crescent bodies in the blood, flagellate bodies would develop within the mosquito. The crescent bodies though deemed sterile, seem capable of inducing another stage of the parasite. The flagellæ are the male elements termed microgameti, and are analagous to spermatazoa, penetrating the female macrogameti in a true sexual process; the fertilized female macrogameti change their shape, become the encysted coccidia of the stomach wall, in which coccidia sporoblasts develop, becoming the sporozoits or germinal threads, which, upon rupture ot the coccidia, are carried to the salivary gland and thence by the bite of the mosquito back to the intermediary host, to begin again the double cycle of development of the parasite.

It may be considered proven, therefore, that the malarial parasite possesses an extra-corporeal cycle, the determined cycle being that the malarial parasite obtained from the human body through the bite of the female mosquito, the male being rarely known to bite, develops and reproduces in this individual mosquito and is thus prepared to reinfect man.

The type of disease transmitted is characteristic of the form of parasite upon which the mosquito has been fed. According to Lewkowicz, there are clinical grounds for assuming that in cases of intermittent fever at long intervals—23-day type—it takes the crescents twenty-two days to develop; the benign tertian, the twenty-three day type and the malignant tertian being all due to the same polymorphous parasite.

There are five species of anopheles thus far known to transmit malarial infection, that of anopheles claviger, also known in the United States as anopheles maculipennis, the "dapple-winged" mosquito, distinguished by its five spots on each wing, being the chief culprit.

Appertaining to their habits of breeding. the maternal instinct of the mosquito teaches it to lay its eggs in open stagnant water for its larvæ, during the two or three weeks required for the complete development of the winged insect; the anopheles, termed "puddle mosquito," preferring stagnant pools or puddles in yards, streets or fields of marshy villages, whereas the culex, termed "pot mosquito," prefers pots, pans, barrels, wells and other artificial accumulations of stagnant water. St. George Gray found that the mosquito larvæ developed from grass picked from the sides of a dried pool, and be-

lieves that the eggs of anopheles remain fertile for a long time after drying. Dr. Howard states that while the anopheles have been found at an elevation of one thousand feet they are usually found at a lower altitude; thus accounting no doubt for the apparent freedom from malaria at high altitudes.

The natural term of life of a mosquito is from thirty to thirty-five days.

The belief at present is strong among both clinicians and bacteriologists, that the difference between the pernicious and the non-pernicious type of malarial fever is simply one of degree. Dr. A. A. Smith, before the Practitioners' Society of New York, at its 150th meeting, reported a fatal case of the pernicious type, showing to what an enormous extent the plasmodium of malarial fever can exist in the human body, nearly every variety being found, lacking only rosettes and pigtails; the small round and crescent forms were in great abundance, especially in the spleen and to a lesser degree in the liver. The assistance of the microscope, with lenses magnifying from 800 to 1200 diameters, in the recognition of the malarial micro-organism, offers a positive means of diagnosis.

Infection takes place more especially in the evening hours, and more particularly out-of-doors, the anopheles not being so abundant within doors as the culex; moreover, the anopheles are more apt to be found in the country than in the city.

The problem of elimination of malarial fever evidently hinges upon the destruction of the anopheles mosquito. It may be considered fortunate that every mosquito is not capable of conveying the infection else it would preclude all possibility of exterminating them. To differentiate between the anopheles and culex, to study the characteristics of the former and a crusade against these, is the rational method of combating malarial infection. To attempt to obliterate the adult parasite-bearing mosquito would be an impossible task; by locating their nurseries and destroying their larvæ seems the only true method of their extermination.

The controlling influence obtained over the disease by efficient prophylactic measures is evident; those advocated comprise the drainage and abolishing of all stagnant and breeding pools or places; the destruction of the larvæ by scattering petroleum on the surface of the waters; and the introduction of small fish into such breeding waters, the fish devouring the grubs.

Finally, an infected malarial person is ever a source of danger as to his environments, and the necessity of his isolation therefore cannot be too strongly emphasized. It has been well said that, the benefit to mankind of the result of the laborious work that has been done by scientific men in this field of research is only equalled by that attained in other fields of medicine and surgery, and that those who have contributed to this are entitled to full meed of praise.

MALARIA—ITS ETIOLOGY, SYMPTOMS AND DIAGNOSIS.*

By H. STUART MacCLEAN, M.D.,
Richmond, Va.,
Professor of Physiology, and Lecturer on Bacteriology in University College of Medicine.

On the *early history* of malaria volumes have been written. The disease is mentioned in the works of Hippocrates, who studied it closely and divided it into the three chief varieties which we now recognize. From early time the association of the disease with low, marshy land has been noted and commented upon, and surmises both ingenuous and difficult of contradiction advanced.

The parasites of malaria, commonly (and erroneously, as Thayer has pointed out) known as the plasmodium malaria, belong to the lowest form of animal life, known as protozoa. They are placed among the sporozoa according to the classification of Butschli, sporozoa being those unicellular animal bodies which reproduce by division into a number of smaller bodies, or sporulation. Too much space would be required to give in detail the development of our present knowledge concerning the parasite and how large a number of observers have contributed to what has become one of the most astonishing advances in medicine in the last few years. Richards suggesting the intra-corpuscular or endoglobular development; Golgi, the connection between sporulation and the paroxysm; Marchiafava and Celli first claiming that the so-called parasites were altered blood cells, then after careful investigation not only retracting this claim, but substantiating and materially adding to the data already at hand; these and many others are familiar to students of the subject. After Laveran's discovery, until 1894 practically nothing was known of the method of infection and the different phases of the life cycle of the parasite. As has been said, the fact that the parasite assumed various forms and developed spores in the circulation, thus perpetuating its existence, was clearly seen, but how the parasite was transmitted from a sick to a healthy individual was not at all understood. In studdying the parasite it had been demonstrated that all forms began their existence as small, colorless, hyaline bodies, non-pigmented, located in the red corpuscles, and having more or less active amœboid movement. These gradually increased in size, developing in their substance granules of pigment until they equaled that of the normal red corpuscle. Here, however, the first and a most important distinction was made. While the great majority of parasites went on to sporulation (called sporocytes), others did not so terminate, and some were seen to develop what were first taken to be flagellæ on their surface. These were known as the flagellated parasites, and are even so spoken of to-day, although it is clear that such is not the nature of these filaments. The flagellæ were never noticed in freshly drawn blood, but developed on the slide shortly after withdrawing from the body.

* A paper leading the subject for general discussion at the annual meeting of the Medical Society of Virginia, at Charlottesville, Va., October 23-25, 1900.

This fact prompted investigation by Manson, of England, who advanced the theory that these "flagellated" parasites were the initial stage of a second life cycle of the parasite occurring outside the human body, probably in some insect capable of transmitting the disease. In this he was correct, with the exception of one slight detail. Manson thought that the filaments, which were seen to break off and move rapidly among the corpuscles, were spores (zoospores) which simply developed into parasites; such is not the case. At this point McCallum, of Baltimore, studying the blood of birds infected by a parasite similar to the plasmodium, announced that the peculiar "flagellated" parasites (gametocytes) are possessed of sexual properties, being either male or female, and that when they are taken into the intestinal tract of the mosquito (which, it seems, plagues birds as well as men) the males rapidly liberate a number of these filaments (known as microgametocytes). These filaments search out the female gametocytes and fertilize them, this fecundated cell being known as a zygote. This "mother-cell" is situated in the intestinal wall and grows rapidly for about seven days. Stimulated by Manson's articles, Ronald Ross took up the work along this line, substantiating the above observations of McCallum, and in further study found that the increase in size of this "mother-cell" was the result of the development within it of a large number of germs or blasts. At the end of the seven days the zygote ruptured and these parasite embryos were set free and distributed throughout the body of the mosquito. In studying his mosquitoes Ross noticed that large numbers of these little bodies were gathered in a gland about the head of the mosquito. This gland was found to empty through a duct passing along the under surface of the "stinger" of the insect. This gland is known to secrete an irritating fluid which is injected when the insect stings, and is supposed to facilitate the flow of blood from the puncture. It was, therefore, easy to see how simple the method of infection really was. The young parasites are deposited in the puncture with the poison and infection results.

Clear and simple it appears to us now, yet it required over two years of work, with at first but failure to reward him, before Ross was able to demonstrate the above. And all because for two years he experimented with but two varieties of mosquito of the genus Culex, the commonest of these pests, which are now known to have no concern nor place in the transmission of the disease. Finally a native brought him a few mosquitoes of a different genus, and in these he readily found the parasite.

We have said that the parasite showed varying characteristics in the blood, and these distinctions constitute the several forms of organism. The parasite of a tertian fever is to be distinguished from that of a quartan or æstivo-autumnal fever, and a differential diagnosis can be made from an examination of the blood without a knowledge of the clinical history.

The question is often asked as to the place of the daily or quotidian fevers in this arrangement. Curiously enough, there is no distinct parasite for the daily variety; a double infection of the tertian, in which two sets of the parasite reach the stage of sporulation on alternate days, brings about the daily paroxysm. In the same way triple sets of the quartan parasite may produce daily paroxysms, and the irregular forms of the æstivo-autumnal fevers, by having groups of parasites which sporulate on successive days, produce a quotidian fever. Fevers which at first are tertian or quartan may become quotidian; therefore, by the development in the blood of separate groups of parasites whose maturity (or sporulation) occurs on successive days, and then under the influence of improved surroundings, etc., the character of the fever may change spontaneously, without the use of quinine, and chills occur every other or every third day, according to the form of infection. Such changes are commonly seen in the course of malarial fevers, and are explained on the ground that one or more generations or groups of the parasite diminish in number until their sporulation is sufficient to produce the customary paroxysm.

Mode of Infection.—It is argued that infection may take in one of three ways: 1. By infection from without, either by inhalation, ingestion or inoculation. 2. By direct inoculation with malarial blood. 3. By the placental circulation.

1. For many years it has been commonly believed that breathing impure air or drinking impure water transmitted malaria. The theory to-day has many supporters who claim that it is at least one method. There is lacking the one requisite in such a case, however; that of actual demonstration. No authentic case is on record where the disease has been proven to be due to either the one or the other. Exception might be made for a case reported by R. Ross, who had a patient drink water containing the dead bodies of infected mosquitoes, with the result that the patient developed fever some ten days later and plasmodium were found in the blood. In many subsequent experiments he was unsuccessful, and there is reason to presume that this was an accidental infection. The theory of the contraction of malaria by inhalation has likewise been vigorously discussed, but here the arguments are more easily controverted. The discussion is materially limited by the exact knowledge at our command concerning the etiology of the disease, and all arguments must agree not only with certain laws or conditions, pertaining to certain atmospheric conditions, but must recognize the parasitic factor. Indeed, evidence which has been quoted as supporting the possibility of infection in this manner has been proven by experiment to have the opposite effect. For instance, the careful studies of Italian observers in and about the malarial districts of Rome have resulted in demonstrating that restriction of malaria within limited areas persists in spite of prevailing winds, which should result in the spread of the disease; then the fact that infection is more pro-

lific after rains, when the dust is laid, than during or after the prevalence of a dust storm, is against the theory. Bignami has shown that when ships lay off the shore of malarial districts only those sailors whose duties keep them for a considerable time on shore contract the disease. It is likewise difficult to explain, on these grounds, why the night should be the usual time for infection. Direct inoculation with malarial blood is a certain method of reproducing the disease, and was noted in the 80's by Italian investigators; it is of value simply as confirmatory evidence of the casual relation of the parasite. Congenital malaria has never been demonstrated. It is probable that the fetus in utero enjoys immunity in the case of maternal malaria, and such a condition is explained by the fact that the parasites show no inclination to leave the circulation. In cases of pernicious malarial fever with cerebral hemorrhages the parasites are never found in the extravasated blood, and this peculiarity has prompted the inference that congenital malaria can scarcely occur.

Infection from without by inoculation is the theory which alone is supported by actual proof. The work of Ross and several Italian observers has established it fully, as has been briefly outlined. After Ross discovered the peculiar variety of mosquito which acted as the host for the parasite, his observations were confirmed by Bignami, Grassi and others, and it became generally recognized that one variety was capable of transmitting the disease from man to man. There are six genera of this insect recognized in the United States, and but one is capable of transmitting the parasite. These, the genus Anopheles, have been found at fault in every instance. The most common variety of mosquito is the genus Culex, the ordinary house mosquito; but these have never been identified as carriers of malarial infection. These discoveries have great practical value, for, having definitely ascertained the cause of the disease and the agent concerned in its transmission, such knowledge makes possible the adoption of preventive measures. First, we are enabled to detect readily the presence of the Anopheles. While at rest the Culex has its body parallel to the surface on which it is located; the Anopheles, while at rest, holds the body at right angles to the surface. The favorite breeding places of the Culex are rain-barrels, drains, ditches and other artificial collections of water about houses, while the Anopheles are found in stagnant ponds or pools removed from the immediate vicinity of towns.

Measures for the destruction of breeding-places and the destroying of the mosquitoes may be practiced with good results. The beneficial effects of drainage need but to be mentioned, for they were recognized long before the true source of infection was known. Where drainage cannot be utilized to advantage, the introduction of fish into the pools is of benefit, as these feed upon the larvæ and nymphæ; or the establishment of a current in the water prevents the development of the adult mosquito. More practieal, however, is the use of agents for the destruction of the insects and their eggs.

Considerable experimentation along this line has resulted in the discovery that large surfaces of water can be effectively rid of mosquitoes' eggs at a comparatively trifling cost. Petroleum is very efficient; one ounce applied to stagnant water will destroy the larvæ, etc., for an area of eighteen square feet. Permanganate of potassium and sulphate of iron are likewise recommended. The time will probably soon be when malarious districts are systematically treated along this or similar lines, with the view, and the effect, of materially diminishing the prevalence of the disease; perhaps eradicating it.

Immunity.—It is conceded that there is a relative degree of immunity attainable to the disease. There are undoubted instances of natural or inherited immunity, but they are rare. Whole families are noted to be free from infection in districts where every one else has the disease. Acquired immunity is of much more frequent occurrence, and it may be said to assume two forms; that in which the immunity seems to accumulate in power as the patient experiences successive relapses, each one milder than the preceding, until the patient ceases to have paroxysms or any malarial manifestations other than a varying enlargement of the spleen, and perhaps some cachexia; and the form in which the patient, from the time of entering a malarial district, never experiences a typical malarial paroxysm, but presents from time to time nervous or digestive derangements which have the one characteristic of periodicity. These latter cases, as the Italian writers have pointed out, occur usually among the better classes. Such instances may be said to be really a persistence of the disease in a chronic but mild or atypical form, yet the fact remains that such individuals enjoy freedom from severe, typical attacks. Instances are commonly reported from the west coast of Africa of natives who, having visited a malarious district and there sustained an attack of the fever, can subsequently visit that region without incurring another attack.

Relapses.—The possibility of relapses in malarial fever should at all times be borne in mind. The distinction must be clearly made between a relapse and a recurrence. The latter is the result of insufficient administration of quinine, and takes place a day or so after the apparent recovery. A relapse may occur weeks, months or even over a year after the primary attack, and is due to the initial infection. The explanation is that upon recovery from the first attack the parasites are so reduced in number and the body attains so marked a capacity for protection that the remainder of the parasites continues in the larval or latent state until, by gradual increase or diminished vitality on the part of the individual (or both), they are capable of again producing a paroxysm. This renders easy the explanation of the presence of malaria at a time when, and in a locality where, the disease does not exist—a point for some time used against the causative relation of the parasite.

The subject of the pernicious forms is far beyond the scope of this paper. Attention might, however, be directed to the multiplicity of diseases which are simulated by this variety of malaria, for no subject is of more practical importance to the physician. The pernicious forms are the product of the æstivo-autumnal parasite complicated by imperfect treatment or lack of treatment. Such cases, starting probably as an ordinary fever, seem to accumulate virulency by each successive attack, lose their identity as frank malarial infections and exhibit symptoms entirely at variance with an ordinary attack. Prominent among such instances are the profound nervous disturbances noted at times. The comatose, delirious and convulsive forms are of sufficient frequency to be more or less familiar to the general practitioner, but other forms are not infrequently erroneously diagnosed. Meningitis, ataxic conditions, localized neuralgias, intestinal lesions—these are some of the more common diseases simulated or even produced by malarial infection. In all such cases will be found the æstivo-autumnal parasite. It is known that these parasites possess a greater toxicity and they multiply more rapidly, and these facts are used to explain their causative relation with the pernicious fevers. The Italian writers believe this to be the case and assert that as a rule, in pernicious fever, an increased number of the parasites are present. They admit, however, that in some pernicious cases of long standing the number of parasites gradually diminishes; they may in rare instances entirely disappear, while the untoward symptoms persist and a fatal termination ensues. The explanation that in such cases the symptoms are due to an increased virulence on the part of the remaining parasites is only a conjecture, and it seems as reasonable to believe that much of the disturbance is due to the blood, and other structural changes brought about by the infection.

It is well known that profound changes take place in the blood in malaria, aside from the presence of the parasites. For a long time before the organism had been recognized a diagnosis would not infrequently be based upon the presence of dark-brown or black granules of pigment free in the plasma or contained in the leucocytes. During the growth of the parasite in the red blood corpuscle it possesses the property of converting the hemoglobin into a pigment known properly as melanin. Not long ago the writer was able to diagnose a case by recognizing these granules in a specimen of blood in which the plasmodium were very scarce, due to the time of collection of the specimen.

At the same time there is deposited in the cells of the tissues a pigment derived from the remnants of the disintegrated corpuscles and those which die because of the depressing influence of the infection without having served as hosts to the parasite. Marchiafava and Bignami, in their recent work on the subject, express the opinion that pigment is to be found in the blood in every case of malaria.

The anæmia produced is a constant symptom, and is the result of the destruction of red corpuscles by the parasite infesting it. At first the body is able to restore the original number of corpuscles between each attack, but as the disease continues the recuperative power of the blood-making organs diminishes and a constant anæmia results. In protracted cases this anæmia is of serious import, reaching as it does as low as one million cells per c. m. m. It calls for especial attention, for not a few of the sequelæ and complications of the disease are due to the impaired oxygen-carrying power.

Chronic malaria is a subject of considerable importance. Every physician is confronted at times with cases of malaria but imperfectly relieved by the routine treatment, and presenting year after year a progressively increasing cachexia with repeated attacks of fever. Here it might be noted that chronic malaria is at times diagnosed when there is sufficient evidence to warrant it. Carcinoma, chronic suppuration, general tuberculosis, even pulmonary tuberculosis, bone disease, and many other such, are mistaken and treated for chronic malaria. This condition is the result of incomplete eradication of the initial attack, with subsequent relapses or repeated reinfections. The distinction between it and simple relapses lies in the cachexia and the organic changes which take place. The organs chiefly affected (spleen and liver) show but the natural sequence of the disturbances which pertain to every case of acute malaria. The disease produces an engorgement of these organs, with deposit of pigment in the endothelial cells and even in the parenchyma. The disputed point as to whether malaria can produce hepatic cirrhosis cannot be positively answered yet, but it seems very probably that this constant congestion and cell irritation might readily produce an increase in the connective tissue. Amyloid degeneration is a frequent accompaniment of chronic malaria, attacking chiefly the kidneys and producing changes which materially increase the severity of the trouble. In all these cases the gravity of the disease rests not with the malaria, but with the condition it has produced.

The urine presents some points of interest. Rem Picci has called attention to the increased elimination of urine after the relief of an attack of malaria. This symptom pertains in from forty to fifty per cent. of all cases, and commences from one to ten days after the disappearance of the fever. The significant feature is that this polyuria may become more or less permanent, and in such cases may be misinterpreted by the physician. The amount may vary from 75 to 125 ounces in the twenty-four hours. He explains this polyuria as an effort on the part of the kidneys to eliminate the results of tissue disintegration produced by the parasite and their products.

Differential Diagnosis.—Owing to the variety of diseases which simulate and are simulated by malaria, the question of differential diagnosis is a far-reaching one. The examination of the blood affords ready means of distinguishing, however, and has simplified the matter considerably. Perhaps one of the greatest difficulties now lies

in recognizing grounds for suspecting malaria. For instance, a patient is seen with a history of pelvic tumor, pain and fever, which may be remittent or intermittent. The question as to whether the case be one of purulent inflammation, or some ovarian lesion with complicating malarial infection, is of great importance to the surgeon, who perhaps can ill afford to wait twenty-four hours to note the effect of quinine. Likewise in that class of cases which are seen so often in the eastern portion of Virginia, and which are undoubtedly atypical typhoid fever, the resemblance to malaria in some of its forms is very striking, and can only be differentiated by a blood examination for the plasmodium and Widal's reaction. To the physician who has the time to personally make the necessary blood examinations there is no work in clinical diagnosis which yields such strikingly gratifying results as the detection of the parasites in a case of malaria. It requires a degree of aptness, however, which is attainable only after considerable practice, and the failure which comes at first must not discourage. It should be borne in mind that there are seen in the blood distorted and necrotic red corpuscles which are very readily mistaken for the parasite, and also that occasionally the parasites will not be found in the peripheral circulation during the chill. In these exceptional cases the presence of pigment-bearing leucycytes containing parasites or fragments of red corpuscles, are equally diagnostic, and close search will usually reveal an occasional small hyaline parasite.

A MODIFICATION OF THE MOSQUITO THEORY.*

BY CHARLES R. GRANDY, M. D.
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I do not believe there is a single physician in this Society, who has not given some thought to the subject of the causation of malarial fever, with especial reference to the mosquito as an active agent in its dissemination. There is naturally a wide difference of opinion on this subject, and physicians have as usual divided themselves into two classes—those who do and those who do not accept the mosquito theory, but the line of division between the two factions is more sharply drawn in this discussion than is usually the case. On one side we find a number of younger men, who have used the microscope and who have had hospital and laboratory experience with the fever; while on the other side are the men who have lived their lives in places where malarial fever eternally dwells, and who have exerted their best efforts in combating it. The first class, the progressive, but at times too enthusiastic class, have adopted the mosquito theory. But the second class looks on it with

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doubt and distrust, and, while allowing that mosquitoes may at times cause the fever, it is not prepared to accept them as the sole method of spreading this disease, and indeed many physicians claim that the mosquito has nothing whatever to do with malaria.

In order to obtain the opinions of the men of this latter class, a circular letter was sent to many of the country physicians practising in Eastern Virginia and North Carolina—men with large experience with malarial fever fever in all its varieties, and the answers of some sixty of them have been tabulated and much valuable information has been acquired as the result. It is a noteworthy fact that among the sixty who answered only one person was found who believed that the mosquito theory accounted for all cases of malarial fever. Why is it, then, that these men all look with skepticism on the mosquito theory? Its warmest advocates say that they of the other side do not understand it, or that they are prejudiced. But, while this is certainly true in many instances, there are still a large number of men with wide experience and good judgment who claim that this theory does not explain all the existing conditions, and who, although they acknowledge that mosquitoes can directly transfer malaria from one person to another, believe that this theory cannot possibly account for all of the cases of malarial fever. We must not forget, however, when criticising the mosquito theory, that its originators do not claim it to be proven that malaria can only be transferred directly by the mosquito, although they evidently believe that this is the case.

It will be well, in discussing the mosquito theory, first to state what it is in a few words, and then to criticise it in the light of existing conditions, and see where it applies and where it does not apply. Briefly it is this, and it has been demonstrated to be possible by actual experiment. If a mosquito of the genus *Anopheles* takes malarial blood into its stomach, the malarial organisms, having freed themselves from the corpuscles, invade the stomach-walls, develop there and in about ten days' time produce a number of young organisms, which pass through the blood-vessels into the parotid glands of the mosquito. They can then be injected into the blood of another person, who after some little time develops the same variety of malarial fever as the man from whom the original parasites were taken. It is only in mosquitoes of the genus *Anopheles* that the plasmodium can develop, the *Culex* being entirely incapable of transferring the disease.

In considering malarial fever, or any other disease for that matter, we must not forget the personal equation, although it often seems to be entirely lost sight of in a discussion of this sort, for Nature has always provided means by which the body can combat disease, even though it be often unsuccessful in its attempts. Thus in a healthy, vigorous man, who has not had a very large injection of malarial organisms, the leucocytes can often destroy all or most of the plasmodia, or can keep them down so as to prevent them from produc-

ing symptoms. Then it is necessary for some external cause to lower the bodily vigor, before the organisms can attain sufficient numbers to produce appreciable symptoms. It is also probable that a person can become partially immune to the poison through frequent attacks or thorough heredity. The organisms may thus often remain a long time dormant in the blood without causing any trouble. Every one who has examined blood recognizes this as a fact; and it is likewise proven by clinical experience, when the fever returns in a week or three weeks, or when it first appears after the person has removed from a malarious district.

The mosquito theory explains satisfactorily many of the well-known conditions which have long been recognized as aiding in the production of the fever. To begin with, malaria in these regions is prevalent when mosquitoes abound, *i*, *e*., in August and September. It disappears for the most part when mosquitoes disappear—that is, at frost. Cases which remain or appear in winter or early spring are attributed to latent disease, which is made active by some external cause lessening the resisting power of the body. In eastern North Carolina cases of malarial fever are found in every month of the year, but they are much more common and much more severe in late summer and early autumn. Marked changes in temperature seem to have a striking influence in bringing out this latent malaria, which is especially liable to occur in early spring. These cases, however, are almost always mild and are easily controlled by the use of quinine. Then *Anopheles* mosquitoes have been found in every markedly malarious district. There are places where there are many mosquitoes and no malaria, but these mosquitoes, when investigated, have almost without exception been found to be of the genus *Culex*, as, for instance, I found myself to be the case in northern Michigan. Finally, there has recently come the report from Italy, that five men have lived a month in a very malarious district, working hard by day, but being protected from the mosquitoes by night; and that these five men did not contract the disease, although they took no quinine, while others, doing the same work, but unprotected from the *Anopheles*, suffered from grave forms of malarial fever.

There are, however, objections to the mosquito theory as it now stands, and the great objection to my mind is that it claims that malaria can only be propagated by the direct transportation of the organisms from one man to another. I do not for an instant contend that this does not often occur, for I consider this much a proven fact, but I cannot bring myself to believe that the mosquito alone obtains and disseminates the plasmodia in this way. This too, seems to be the point to which the men with the largest practical experience cannot subscribe, for they do not consider it possible for all the cases of malarial fever to be produced by this direct inoculation.

There is another objection to the mosquito theory to which I have not as yet heard a satisfactory answer. It is this: If the life cycle of the plasmodium is only to be found in man and the mosquito—

that is, that the mosquito takes them from one person and directly inoculates another—and if there is no other host or medium which may at times shelter these organisms, the most malarious districts could be freed from this disease by being depopulated for a year, or at most two years. My reasoning in this matter is very simple. The mosquito only lives a short time, a month at longest, except when it hibernates. If all the infected mosquitoes died, without inoculating more people, as they certainly would do in two years' time, the most malarious district would become healthy. This, however, as far as I have been able to learn, is not in accordance with fact; there being some districts so malarious as to have made depopulation necessary, and yet it appears that if a man goes into such a region, he will contract the fever. Then, too, if an army camps in a swampy, sparsely-populated country, the soldiers contract the fever, and contract it in places where men rarely if ever come. The *Anopheles* do not seem to fly far from their breeding-places. Is it therefore likely, if malaria is only contracted through the mosquitoes, that they have all had the opportunity to digest malarious blood?

Manson believes (or believed) that the mosquitoes give up the parasites when they lay their eggs and die in the water, and that the parasites are then taken into the system by men who drink the water. This is in accordance with what he found to be true in the case of the *filaria sanguinis hominis*. The objection to this is that all the recent investigations have gone to show that malarial fever is *not* contracted from drinking water, either because the malarial organisms cannot live in it, or because they are destroyed by the human stomach secretion, just as they are destroyed in the stomach of the *Culex*. I have a very good example to the point, which I would like to add to those already published. The city of Norfolk obtains its water from ponds lying in a notoriously malarious district, yet the paved and sewered part of the city has long been almost free from malarial fever, although the unpaved and badly drained suburbs, some of which use the same water, have many cases of the fever. Then the City Almshouse, which lies near the water-works and gets its water from it, has regular yearly outbreaks of malarial fever. Last winter a very complete sand-filter plant was instituted, yet there has been no appreciable change in the malaria in any one of these places, perhaps there have been a few more cases this summer than is usual in the city. How, then, can we account for the fever? Around the ponds are found large numbers of *Anopheles* which breed in the drinking water (which by the way, contains many algæ), and in the suburbs *Anopheles* have also been found. Where this mosquito is found, there we find the malaria; but the drinking water, filtered or unfiltered, has no appreciable effect, as the people in all these localities use the same, yet one place is almost free from malaria, while another has regular outbreaks in the autumn.

Then it has been thought that the plasmodia might pass through the eggs into the larvæ and remain till the mosquito was grown, and that they then could be inoculated by it. This seems to be true in the case of the organism that produces Texas fever and which is inoculated by a tick, but actual experiment has disproven it in the case of the human malarial organism.

There is another modification of the mosquito theory which overcomes these objections, and, although it is still mere hypothesis, it appeals to me strongly. To begin with, we will acknowledge that in a certain number of cases malarial fever is directly transferred from man to man by the *Anopheles*; so much is proven beyond question. But I believe this to be the fact in only a very limited number of cases. How then can we account for the great majority of cases of fever? I still believe in the potency of the *Anopheles*, but believe that they can, and do, obtain the organisms from other sources than direct from the human blood. We know that this genus injects the young malarial organisms from its parotid gland into the blood of the man upon whom it is feeding. Is it not likely that it, when feeding on other things than human blood, which seems to be more of a delicacy than a staple article of diet with the mosquito tribe, should also inject the parasites into whatever it is eating? Other uninfected *Anopheles* may take in the parasites directly from this food or water; or the plasmodia, in the form in which we find them in the parotid glands, may be able to live in water or damp soil as other sporazoa do, and later on they may be taken up by other *Anopheles* and be inoculated by them into man. It is also possible that the plasmodia may pass into the water from the bodies of the *Anopheles*, which have died in the water after depositing their eggs, and may be taken up in feeding by other mosquitoes.

All the arguments in favor of the mosquito theory apply equally well to this modification, but the modification explains some points to which the original does not thoroughly apply. Let us, then, briefly criticise this modification of the theory and see if it will hold good under all conditions. Naturally many of these will apply to the theory as it now stands, as well as to its modification. In the first place wherever malarial fever regularly appears, there we find the *Anopheles*. There may be places with this mosquito and without malaria, but if the disease is brought there by man, the insect can spread it.

This has been observed in the case of an East Indian island, whither the fever was brought from India, and where let us remark it still remains. The *Anopheles* breed only in pools and not in tubs; they are the country mosquito in contradistinction to the *Culex*, which is found in both towns and country. This explains why there is so much more malaria in the country districts. They feed at night, which fact explains the influence of night air in producing malarial fever. They are most numerous at the time of the heavy dews (in August and September), the effect of which is thus ac-

counted for. Their larvæ feed on algæ, hence the theory that stagnant water causes malaria. It has long been noted that the digging up of old swampy soil causes an increase in the number of cases of malarial fever. This can be accounted for either by furnishing fresh breeding-places for the mosquito, or possibly by the exposure of dormant parasites, which are then taken up by the *Anopheles*. Malaria is severer in warm, rainy seasons, because this both furnishes the insect with more and better breeding-places, and likewise allows it to obtain more of the extracorporeal organisms. On the other hand, the drainage of the soil deprives the *Anopheles* of breeding-places and kills the extracorporeal organisms by depriving them of moisture. The eucalyptus tree stops the malaria by driving off the *Anopheles*. It would be interesting to know if the fever would return as soon as the trees were cut down, and more especially if young *Anopheles*, raised in the laboratory and free from infection, were turned loose there. As I remarked before this modification explains how uninhabited districts still may remain malarious, and this the unmodified theory does not do. It explains how the fever is disseminated without direct reinoculation; for this would imply either very active work on the part of the infected mosquitoes which have lived through the winter, and which must be comparatively few in number, or a very large number of cases of dormant malaria, from which the young mosquitoes could obtain the parasites. Whereas the writer realizes the large number of these cases, he does not believe them sufficient to alone restock the *Anopheles* with plasmodia. It likewise must not be forgotten that most of these dormant cases seem to develop in early spring, when there are no *Anopheles* to be infected, and that they readily respond to treatment, which would destroy the parasites before the *Anopheles* would have a chance to obtain them.

The original experiments by Bignami simply showed that *Anopheles* taken from a malarious district could produce the fever in a healthy man by biting him, although his later experiments showed that they could directly transfer the parasites from one person to another. Consequently many of his experiments speak as strongly for the modification as they do for the theory, for the mosquitoes might have obtained their organisms from sources other than human blood.

There are two objections to this modification of the mosquito theory. The first is that the malarial organisms have never been cultured artificially. To this we can reply that no other parasitic protozoon has been thus cultured, and that we must not demand more in one case than in the others. The second is that they have never been found free in nature. We must consider in regard to this point how very minute are the tiny thread-like organisms found in the mosquitoes' parotid glands and how easily they could escape observation when looked for in water, let us say, and that up to the present year they would not have been considered in connection

with the *plasmodium malariae*, even if found, and might readily have passed for bacteria. Experiments made with the organism as found in the human blood will have to be cast aside as proving nothing, and every experiment in regard to the extra-corporeal life of the plasmodium will have to be tried with it in this thread-like stage, for it is from this stage that it passes into the external world, if it does so at all.

A positive proof of what I have just read cannot as yet be shown, and further investigation may overthrow it. Nevertheless I claim that this modification of the mosquito theory comes nearer fulfilling all conditions and answering all objections than any theory that has come under my notice. Like all hypotheses, for it is nothing else, it needs further investigation, which will either strengthen or overthrow it. Still it is at least worthy of consideration, and as such I present it to you, hoping that it will be criticised fully and severely for if it will not stand criticism, it had much better never go beyond the doors of this hall.—*Med. News.*

ETIOLOGY AND DIAGNOSIS OF MALARIA.*

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The plasmodia, hæmatozoa, or sporozoa of malarial fever are best studied in a *fresh* specimen of the blood. A $\frac{1}{12}$ oil immersion lens and mechanical stage are preferable. In examining the fresh specimen the microscope should be taken to the *bedside* of the patient and the blood maintained at the body-temperature; carrying the specimen from one room to another frequently destroys it. A warm stage may be easily made of a long strip of copper plate adjusted to the stage of the microscope and tapering toward one end. This is laid on a piece of flannel or felt, and a small alcohol lamp placed at its tip. In the summer months the slide should rest on a piece of flannel or felt laid on the stage of the microscope.

The tertian parasite is the best for studying the general characteristics of the malarial hæmatazoa, the blood being taken an hour or two before the expected chill.

With a linen towel the lobe of the ear or end of the finger should be cleansed, first with alcohol, then with water. The warm stage is to be properly adjusted so that the specimen may be preserved at a temperature of 98.2° F. With a needle or tenotome a quick thrust is to be made into the lobe of ear or end of finger, and with the linen cloth, the first drop or two of blood that makes its appearance is to be brushed away. The cover-slip is then held in the blades of the forceps, and touched to the summit of the drop of blood (without touching the skin). One edge of the cover-glass is quickly applied to the side, and allowed to fall by its own weight, when the blood

* Gaillard's Med. Jour.
1 Medicine, May 1900.

should spread out smoothly. One should never press downward upon the cover-slip to assist the blood in spreading. It is time wasted to try to examine a bad specimen. It is always well to collect two or more samples before beginning the examination. The specimen should be examined immediately after it has been withdrawn from the circulation. Several specimens should be collected at different periods of the fever, because the parasites are not always found. As a rule, only a limited number of malarial parasites are discovered in each specimen of blood obtained.

The *Plasmodium malariæ* has a turning, twisting, rotary, or flattening out movement, and in the later stages contains fine pigment-granules in active motion.

It is very common to meet with foreign material and "blood-dust" in the plasma, which at times may be mistaken for the non-pigment hyaline parasites of malarial fever. The bodies may have an active Brownian movement.

In beginning this study one should confine his attention to the parasites within the red cells. In looking for the tertian parasite any enlarged and decolorized red corpuscle should at once arrest the attention.

Except the æstivo-autumnal type of fever, a few doses of quinine will cause all organisms to disappear from the blood.

That which takes the first rank as a source of error in this examination is failure to obtain a good specimen of blood. The three most essential requisites for a good specimen are: 1, a puncture deep enough to make the drop of blood appear immediately (pressure aids this); 2, clean cover-slips and slides, and, 3, dexterity of movement in transferring the specimen.

Another frequent source of error is to mistake the vacuoles of red cells for hyaline malarial parasites. During the process of necrobiosis the red cells take on a peculiar tremulous or wavy motion, which is imparted to the contained protoplasm. At this time vacuoles of different sizes and shapes may be seen within the red corpuscles. In this clear space no pigment, of course, is seen, and it is motionless. In stained specimens prepared by overheating they are very common.

After the death of the red corpuscle, small, round, colorless (hyaline) bodies, $\frac{1}{20}$ to $\frac{1}{4}$ the size of a red cell, with a sharp or clear-cut outline, may frequently be seen within the red cell. They are motionless. These bodies are abundant in the stained specimen improperly prepared by over-heating, and may also be found in specimens prepared by fixation in ether and alcohol. In focusing up and down they change in appearance and color, while the malarial parasite does not do so.

Occasionally the hæmoglobin will collect in certain portions of the erythrocyte, assuming peculiar shapes, mostly oval, but without motion.

The amœboid motion of the white blood-corpuscle (polymorphonuclear leocyte) is not infrequently mistaken for the full-grown malarial parasite. Its nuclei will, of course, be easily recognized after some practice.

Minute, colorless, highly-refractive granules may be seen free in the plasma; the so-called "blood-dust." They generally result from disintegration of the red cells and leucocytes. Fat particles and ordinary dust may also be found in many specimens. These foreign elements often have an extremely rapid Brownian movement. The particles usually take the course of the spaces between the corpuscles, but not infrequently roll around and lodge immediately over a red cell. Peculiar motile micro-organisms which make their habitat on the normal skin may also be introduced in making the puncture. It should be remembered that the hyaline segmenting malarial parasites are seldom found free in the plasma.

Small reddish particles of destroyed hæmoglobin of different sizes and shapes may also be seen in the plasma in normal blood.

Foreign bodies are differentiated from the malarial parasite by focusing up and down, when the former material is seen to have sharp edges and changes its color and shape, in contradistinction to the malarial parasite, which does not change its shape on change of focus, but becomes easily visible or fades away gradually in the protoplasm of the red corpuscle. In searching for the malarial parasite the best focal point seems to be that at which the shaded central portion of the red cell is most plainly visible.

The malarial parasites are, as a rule, relatively few in number in each drop of blood obtained, and frequently fifteen minutes may be required to find a single specimen.

After learning the characteristics of the different forms of plasmodia in the fresh specimen of blood, the staining methods may be used. The puncture is made as advised in the fresh specimen, the clean cover slip held in the forceps is quickly touched to the summit of the drop and then immediately placed upon another slip, which is at once separated by sliding the upper one along in the plane of their surfaces.

The blood is then fixed by heat, preferably in a dry sterilizer or oven. In the absence of the sterilizer, one may secure a plate of copper fifteen or eighteen inches long, one-eighth to one-sixth inch thick, and three inches wide, and heat for fifteen or twenty minutes by placing at one end a Bunsen burner or oil-lamp provided with a double wick, or Rochester burner. The entire apparatus must be well protected from all draughts by means of a wide piece of tin or be placed in a closed room.

The proper temperature to heat the specimens is from 239° to 248° F., which is determined by collecting a few drops of water in a pipette and throwing somewhat forcibly along the upper surface of the copper plate in the direction of its cooler extremity. The drops of water soon cease rolling, and the point where the drop suddenly

stops will generally correspond to about 248° F. (or 120° C.) It is safer to place the drop of blood an inch or two nearer the cooler end than this point.

After the blood has been thoroughly dried in the air it is then placed (smeared side upward) upon this plate at the point designated and allowed to remain from fifteen to thirty minutes, continuing the heat all the time. It should then be removed and stained. Only the purest stains (Grubler's) should be used. One of the best and most reliable stains is that of eosin and methylene-blue.

After removal from the plate the specimen is covered over with a $\frac{1}{4}$ to $\frac{1}{2}$ per cent. solution of eosin in 50 per cent. of alcohol and stained in the cold from three to five minutes. It is then washed in water for a minute (eosin stains the red cells intensely) and the excess of water is removed carefully with a blotter. After the specimen is dry it is then counter-stained (also in the cold) for five minutes with a saturated aqueous solution of methylene-blue, washed for half a minute, dried with blotting paper or in the air, and mounted in Canada balsam. By this method the red cells are stained a pinkish color, the plasmodia blue, and the pigment remains very dark. The nuclei of the white blood-corpuscles stain blue.

The three most common errors committed in examining the stained specimens are perhaps: (1) failure to collect the blood properly, (2) carlessness in placing the stain upon the specimen, and (3) overheating the specimen.

As in the fresh specimen, small, round, unstained, highly-refractive bodies may be seen in the red corpuscles. These products result from the process of necrobiosis of the red corpuscles. They are very abundant in overheated specimens. When the blood has been stained by Ehrlich's method many small pinkish dotlets are observed.

The kary kinetic figures of the leucocytes should not be mistaken for the malarial parasites.

If crescent or ring-shaped organisms are found, this fact at once denotes infection by the æstivo-autumnal parasite.

Another frequent error made by beginners is to mistake the clear spaces (vacuoles) in the red cells for malarial parasites.

Very large, irregular, jagged hyaline crystals and irregular, deep-blue masses are seen free in the plasma, which are doubtless due to disentegrated blood-corpuscles.

C. N. B. Camas[2] remarks that for years malaria has been made the scapegoat for all conditions of the character of which one may be uncertain. Every patient with an intermittent fever associated with malaise of uncertain origin—especially if such a patient resided in a malarial district—was said to be suffering from malaria. Malaria is to-day one of the few diseases that can be positively diagnosed. No case should be diagnosed as malaria unless the *Plasmodium malariæ* has been found in the blood. Examinations for this organism need a microscope and the knowledge how to use it. Unfor-

2 Jour. Amer. Med. Assoc., July 28, 1900

tunately the blood is not frequently submitted to this test. If this were done, beginning cases of tuberculosis and intermittent fevers in pneumonia would be much less frequently called malaria.

Patrick Manson[3] thinks that few diseases are so easily diagnosed as malaria. There are three pathognomonic tests which, intelligently applied, are absolutely infallible. There is the clinical test of periodicity, but diurnal periodicity is of no value in the diagnosis of malaria. A periodicity of twenty-four hours is shared with malaria by many diseases, but it is otherwise with a periodicity of forty-eight or seventy-two. Only one pathological condition exhibits this feature and that is the malarial infection. Any disease exhibiting a tertain or quartan periodicity is certainly malaria. But one should not put any reliance upon quotidian periodicity in the diagnosis of malaria; it is most misleading; and constantly gives rise to mistake. If a patient has well-marked rigor followed by pyrexia, and that by profuse perspiration, and if this occurs day after day, the conclusion must not be jumped at that the case must be malarial because of the periodicity and because the patient is from a tropical country. In diagnosis quotidian periodicity should be absolutely ignored. A patient with well-marked abscess of the liver has been personally seen, the patient himself being a medical man, and yet because he had rigor, pyrexia, and perspiration day after day he was sure that he was suffering from malarial fever, and he was taking quinine in consequence. Nearly all suppurative processes are attended by a fever with a quotidian periodicity more or less marked. Osler says that he never sees a case of abscess of liver that has not been drenched with quinine, the diagnosis of malaria having been made doubtless in consequence of the quotidian recurrent pyrexia. Many diseases—ulcerative endocarditis, surgical kidney, gall-stones, syphilis, tubercle, almost every disease with febrile associations—may exhibit quotidian periodicity. But it is otherwise with tertian and quartian periodicity; these are both absolutely pathognomonic of malaria. Then there is the therapeutic test; the test by quinine. Quinine properly administered in a case of malarial disease in forty-eight hours is, in personal experience, invariably followed by abatement of the symptoms. If a patient is given quinine for seventy-two hours and there is no abatement of fever, the diagnosis should be reversed: the patient is not suffering from malaria. There is no use in persisting with quinine for days and weeks on the supposition that the case is malaria. The malarial parasite can be poisoned with quinine as certainly as a man can be poisoned with arsenic.

It is not sufficient, however, to rely on the therapeutic test, because in many instances there is no time to wait for its application, as in grave cerebral attacks. By the time the diagnosis is established the patient might be dead. It is necessary to have some more rapid means of arriving at the conclusion of what is the matter with the patient. That is supplied by the microscope; it is an immediate

3 Lancet, July 21, 1900.

and invaluable test for malaria. Practitioners in tropical countries fail in their duty to their patients if they do not acquaint themselves with the application of the microscope in the diagnosis of malaria. For the practitioner nowadays to undertake the care of life in tropical countries and to be ignorant of the use of the microscope in malarial diagnosis is positively culpable. The microscopical test is easily applied. All that is reqaired is a high-power lens, a $\frac{1}{12}$ objective, a fair illumination, and two or three slides, some cover-slips, and a patient. In five minutes one can tell whether the patient is suffering from malaria or not.

C. F. Craig[4] finds that from observations of æstivo-autumnal malarial fever in this country and Cuba, comprising both microscopical and clinical study under exceptional conditions as regards opportunity and material, he is forced by the logic of facts to confirm Marchiafava and Bignami's conclusion regarding this type of malarial fevers. There undoubtedly exist two varieties, at least, of the malarial parasite giving rise to these fevers: one having a cycle of development of twenty-four hours, and giving rise, in uncomplicated cases, to a fever having quotidian paroxysms; the other, having a life-cycle of forty-eight hours, and giving rise to a fever with tertain paroxysms, in which the temperature-curve is peculiar and characteristic.

Ronald Ross[5] points out that in old cases of malaria there may be a secondary form due probably to enlargements of the liver and spleen: a form of a continued type not directly due to the parasites and not amenable to quinine. This form has been noticed also by Vandyke, Carter, Kelsch, Kiener, and others, and was personally observed while studying kalaazar. Torti was the first to point out that quinine should be given before the access. The drug should be continued for three months after infection, and it is best given in solution.

J A. Capps[6] has has four interesting cases of malaria associated with acute abdominal pain. The patients were all women and were send to the hospital for operation for acute salpingitis; gall-stone colic or gastric ulcer with perforation, extra-uterine pregnancy, and appendicitis, respectively.

The presence of the tertain parasite in each case demonstrated the presence of malaria, and the subsidence of all symptoms after the administration of quinine confirmed the diagnosis. The cause of the pain must be either (1) some co-existing disease, (2) a neuralgia from malarial poison, or (3) both combined. In not one of these cases was there a co-existing disease in an *acute* state. This point was indicated by the absence of leucocytosis, and illustrated the value of the leucocyte-count. The neuralgias of malaria may be divided into (1) the toxic, occuring during the febrile attack, associated with the presence of the plasmodia in the blood, and due to an intoxication with the malarial poison, and (2) the post-infective

4 Phila. Med. J ur., April 7, 1900.
5 Brit. Med. Jour. September 1,1900.
6 Jour. Amer. Med. Assoc., August 4, 1900.

which are the result of anæmia and cachexia. The importance is emphasized of examining the blood for malaria and of counting the white blood-corpuscles in all obscure acute abdominal diseases. Malarial neuralgias require large doses of quinine.

Etiology.—W. S. Thayer[7] considers it as proved:—

1. That the malarial parasite possesses an extracorporeal cycle which is completed in the stomach-wall of mosquitos of the genus *anopheles.*

That members of the genus *anopheles* can transmit malaria from infected to non-infected individuals.

At the present moment this is the only proved method by which malaria may be acquired. This theory explains most conditions associated with malarial infection; reports showing the protective efficacy of mosquito-nets even in the most malarial districts are rapidly accumulating; there is no serious evidence in support of any other theory.

The evidence at present possessed tends to favor the theory that the mosquito can acquire the infectious agent only from man. The statement is often made, that in tropical Africa, for instance, exploring parties may spend considerable periods of time in the uninhabited interior without illness, even though the regions may appear, from outward conditions, most unhealthy. It is only on their return to the seacoast, to districts where the surroundings would appear to be better, that the outbreaks of malaria occur. This hitherto inexplicable fact becomes clear if one assumes that in the woods, though all conditions are present for a spread of the disease, the mosquitos are uninfected and so harmless; it is only on coming back to the settlement where infected mosquitos occur that the disease breaks out. Studies by Celli and Delpino, by Grassi, by Bastianelli and Bignami, of epidemics in small communities, have shown that the vernal cases of malaria are almost all relapses; that during the month of June the *anopheles* begin to be active; that, about a month after the beginning of the activity of the *anopheles*, the true epidemic of malaria begins, starting apparently in foci about individuals who have recently suffered from relapses of the disease. During the season in which *anopheles* prevail the malarial epidemic flourishes, only to disappear again with the disappearance of the mosquitos.

Prophylaxis.—The Liverpool School of Tropical Diseases[8] states that gnats and mosquitos are scientifically known as culicidæ. The commonest genera are called culex and anopheles, and it is important to know how to distinguish them, because anopheles carry malaria, while the culex appears to be harmless. Anopheles have a slim, elegant body, shaped like that of a humming-bird moth; a small head, and a long, thick proboscis. When seated on a wall, the axis of the body is almost at right angle to the wall, and they generally have spotted wings. The culex has a coarser body, with

7 Phila. Med Jour., May 5, 1900.
8 New Orleans Med. and Surg. Jour , May, 1900.

a thick thorax, or chest, and a thin proboscis. When seated on a wall the tail hangs downward, or even points a little toward the wall, and the wings are generally quite plain. The wings of the anopheles are spotted along the front edge.

The larvæ of the two kinds are equally different from each other. Those of the culex float when at rest on the surface of the water, suspended by their tails, and their heads hanging downward, and when disturbed they wriggle at once to the bottom. But those of anopheles float flat on the surface of the water like sticks, and when disturbed wriggle on the surface with a backward skating movement.

As a rule, man-eating mosquitos like to breed close to houses, and the culex larvæ live in vessels of water, and anopheles larvæ in pools. The first thing to do is to search carefully in and around the house for vessels and pools of water; and if there are many mosquitos in the house, one may be almost sure that their larvæ are somewhere close by. Thus, culex swarm in any old tub or pot of water; in broken bottles, old gourds, flower-pots, cisterns, garden fountains, and even in buckets of water kept for cooling soda-water or washing plates; or in those small tins of water placed beneath the feet of tables and meat safes to keep ants away. They may also swarm in drains and small ditches. To find the larvæ, all that a person has to do is to go and look for them in places like these; he is sure to come across them almost immediately. Little red, worm-like creatures are often found mixed with the mosquito larvæ; these are not mosquito larvæ, but the larvæ of midges.

To find anopheles larvæ one must generally go farther afield. Small pools on the ground containing green water-weed, especially rain water puddles by the side of roads and paths, are their favorite haunts; but they may also be found in puddles on the surface of roads, or in hollows in rocks, in old wells, in drains, in small pools and rice fields, or even in "sloppy" ground among grass, or around stables or byres. Stables and servants' godowns are very favorite haunts for adult anopheles.

In order to kill mosquitos wholesale it is necessary only to destroy their larvæ. This is generally a very easy matter, especially in regard to the culex. One has only to go around the premises at least once a week and to empty out all pots and vessels containing stagnant water, and also to brush out with a broom all puddles containing larvæ. As the larvæ take about a week to mature, this procedure will generally be enough to keep the insects away, but, at the same time, it is necessary to prevent water collecting anywhere near the house.

If mosquitos are numerous in a house, they will generally be found to be breeding just outside the windows. Hence, people can generally keep their houses comparatively free of these pests simply by attending to their own premises.

While small collections of water can easily be emptied out or brushed away, it is often more difficult, perhaps sometimes impossible, to deal with the larger collections of water which moquitos, especially the dangerous ones, breed. In such cases the following measures are to be used:

1. All useless collections of water in which mosquitos breed should be filled up or drained away, if this can be done at a reasonable cost.

2. If this cannot be done, recourse must be had to the habitual use of culicicides. The simplest culicide is oil, especially kerosene oil (paraffin). This, if sprinkled on the surface of water, produces a fine film, which destroys the larvæ by choking their air tubes, or perhaps by annulling the surface tension of the water. But the film must spread all over the surface of the water, and must last for at least half an hour. The oil can best be applied by "painting" the pool with a rag fixed on a stick, and first dipped in a pot of oil; in this manner numbers of pools can be dealt with in five minutes at the expense of very little oil.

Whatever fugitive culicicide is used, it must be used at least once a week. Cisterns and wells of drinking water should be kept covered in as much as possible.

It is sometimes impossible to find the breeding pools of anopheles, even where the adults are numerous in a house. This is especially the case where there is much rank vegetation around the house. Here much good can be done by simply killing the adult insects as they sleep on the walls during the daytime. Flyflappers should be used; it is dangerous to kill mosquitos with the hands, because the insects sometimes contain parasites which cause elephantiasis.

W. H. Vickerstaff[9] says that he has examined a large number of tree pines in Jamaica, but so far has been unsuccessful in finding anopheles larvæ in them; but in almost every instance, whenever there was any water, even a very small quantity, culex larvæ were found in large numbers and of various species. In this district it is believed that the tree pines are the most common breeding places of culex.

C. Fermi[10] has made some experiments in Sassari, in conjunction with Dr. Lumbau and Dr. Cossu-Rocca, with the object of freeing the town from mosquitos. He was able to discover all their breeding places in different parts of the city, in drains, cisterns, puddles, etc. The method adopted was the destruction of the larvæ by means of petroleum placed in the breeding grounds twice a month. The mosquitos were destroyed in shops by means of chlorine, and in houses by means of other culicicides, such as a mixture of pyrethrum, chrisanthemum flowers, valerian, and calamus aromaticus, or the "zanoline" of Celli and Casagrandi. The results obtained were so satisfactory that it is concluded from them that it is always possible to

9 Brit. Med. Jour., June 9, 1900.
10 Brit. Med. Jour., May 12, 1900.

free a town from mosquitos unless the conditions are exceptionally unfavorable—as if it be situated in the midst of a swamp. The expense of freeing a town of 50,000 inhabitants is estimated at $200 to $250 a year. This includes the wages of the staff required to carry out the measures prescribed. The expense is small in comparison with that of other methods, such as smoke cones, which only some 10 per cent. of the people can be got to use it.

Woldert[11] notes the finding of anopheles in December and January in Washington; in Philadelphia up to the end of October; on the snow in Vermont in February, and at various times during the winter even at the North. There is no need, then, for the mosquito to migrate for long distances. It may persist throughout the year even in high northern latitudes. It has been seen on several occasions and at various places within 500 miles of the North Pole. When mosquitos are found during the winter they are always encountered not far from standing water and in the neighborhood of an animal. Where the pupæ of the insects occur they may best be destroyed by the use of a solution of tobacco in kerosene oil.

A. Celli[12] remarks that, as is usually the case, rational prophylaxis depends on accurate diagnosis, and in this case what is necessary in order to verify the diagnosis is to examine the blood either in fresh or stained preparations.

Isolation is the first prophylactic measure, and should be taken directly the diagnosis is verified. In a malarious place a person affected by the fever is very dangerous to others, and should therefore be isolated, malaria being a true and proper contagious disease.

Malarial patients can be isolated in any place where there are no malarial mosquitos.

The best place for isolation would be special sanatoria situated in healthy elevated regions. Inasmuch as the sexual forms of the parasite are the most dangerous sources of contagion, and they, unfortunately, remain for a long time in the blood, the convalescents should not be sent back to the infected places until the absence of the parasite forms most dangerous socially has been verified by repeated examinations of the blood and perhaps also of the spleen.

Quinine is the specific disinfectant for amœboid organisms, and consequently for the malarial parasites in their amœboid stage. The quinine must be given at once at the beginning of the fever and in large doses, 2 grammes (30 grains), for example; it should be repeated in doses of ½ gramme (7½ grains) for several days, and then at intervals of five, six or seven days. But even this treatment, if the patient remain in the infected place, does not always prevent recurrences, and an intolerance for a drug which disturbs the stomach and nervous system so much is easily produced.

Patrick Manson[13] states that the reputed prophylactic action of quinine is but a phase af its therapeutic action; it is the application

11 Med. News, June 9, 1900.
12 Brit. Med. Jour., Feb. 10, 1900.
13 Ibid., Sept. 1, 1900.

of the drug to the parasite, and not an immunizing of the body against the entrance of the parasite, one has to deal with; therefore one may confidently expect that, if it will cure malarial infection, it will prevent its development: the development though, not the introduction of the germ. Further, that as some types of the parasite are highly amenable to the drug given therapeutically, similarly its prophylactic power will be greater against such; thus, one may confidently expect it to be a timely prophylactic as against the benign tertian, but less active against the malignant tertian. The value of the drug is apt to be underrated in consequence of it being given in too routine a fashion, and often under conditions in which it cannot be absorbed, as in states of severe gastro-intestinal catarrh. Such failures should be eliminated in assessing its prophylactic value. It is recommended that, in future, experiments in prophylaxis be made with the aid of the microscope, and in reference to the particular type of malarial parasite it is used against, and also that the gastro-intestinal condition of the individual experimented upon be investigated and recorded.

Pola[14] experimented on 736 soldiers; of 500 who took quinine 18 per cent. were attacked, while of the remainder who did not take quinine 28 per cent. had malarial attacks.

Carre[15] believes quinine diminishes the chance of infection in the simple forms of fever, but is well-nigh useless in the pernicious forms.

Treatment.—An editorial[16] says that the first systematic attempt on a large scale to grapple with the problem of how best to combat malaria in the light of recent discoveries is about to begin in the Argo Romano, and the following is a translation of the instructions issued by the Bureau of Hygiene of Rome to the medical men who are to engage in this campaign.

In primary malarial infections the administration of quinine in tabloids, each containing $\frac{1}{2}$ gramme ($7\frac{1}{2}$ grains) of the sulphate should be recommended during the subsidence or at the end of the febrile attack. The quantity administered should be 2 grammes (30 grains) daily for three successive days and 1 gramme (15 grains) daily for other four days. Tabloids sufficient for a week's treatment are to be given in a small box with appropriate directions to each patient. After the remedy has been suspended for five days it will be well to follow the directions for relapsing cases, even though there be no return of the fever. Hypodermic injections are only to be employed in exceptional cases. The medical officer is recommended to supervise the treatment of primary æstival infections in which the fever of the first attacks should be suppressed as far as possible, experience having proved the importance for prophylaxis of early treatment.

14 Phila. Med. Jour., Aug. 18, 1900.
15 Ibid.
16 Lancet, July 7, 1900.

In relapsing malarial fevers the administration of sulphate of quinine should be carried out as follows:

After the last febrile attack, or during its decline, 2 grammes (30 grains) of the quinine in four tabloids are to be given. The following day the same doses are repeated. During the next five days 1 gramme (15 grains) of sulphate of quinine in two tabloids is administered, after which the treatment is to be suspended for a week. The following week the administration is to be resumed, the patient being supplied with the same quantity of quinine as in the first week, and the quantity taken regulated as before. When the fever no longer returns the daily dose should be reduced by one-half. The administration is then to be again suspended for a week. In the fifth week the same amount is to be given in the same way as in the third week, and so also during the seventh week. As a rule, it is not necessary to continue the administration beyond the seventh week. During the weeks in which the quinine is suspended, the physician may, if he thinks proper, administer "Bacelli's mixture" or capsules and tabloids containing iron.

The treatment of the fever, whether primary or secondary, should be commenced according to the scheme laid down, even when the last attack has occurred some days previously. Whenever the fever asserts itself it is best to recommence the treatment as for the first day and to continue according to the rules prescribed. The total dose of quinine should be given within two hours, i. e., at intervals of half-hour, three-fourths of an hour, or one hour, according to the fractions. A glass of water should, if possible, be drunk after every tabloid, acidulated, by preference, with lemon or vinegar. In children the doses should be reduced in proportion to age.

Hypodermic injections are reserved for cases of intolerance of quinine by the stomach and for cases of pernicious fever. In these cases two hypodermic injections are made, each of 1 gramme (15 grains) of the bihydrochlorate of quinine dissolved in 5 grammes ($1\frac{1}{4}$ drachms) of distilled and sterilized water. A large syringe is employed, the lateral regions of the abdomen being chosen and the skin washed with gauze and absolute alcohol. The needle also should be sterilized with absolute alcohol or by boiling in a test-tube. The hypodermic solutions in sterilized vials, each containing 1 gramme (15 grains) of bihydrochlorate, will be supplied to the medical officer. The patient must then be conveyed to the temporary hospital or to the city. In the hospital injections of camphorated oil and caffeine will be made. During the two subsequent days 2 grammes (30 grains) of quinine must be given daily either by injection or by the mouth, one tabloid of $\frac{1}{2}$ gramme ($7\frac{1}{2}$ grains) every hour. The intravenous injections according to Baccelli's method will be made in extreme cases in the sanitary station hospital. For these injections boiled solutions of neutral hydrochlorate of quinine at a temperature of 40° C. (104° F.) should be employed exclusively

in doses of 1 gramme (15 grains) in 10 cubic centimetres ($2\frac{1}{2}$ drachms) of chloride of sodium solution (0.75 per cent.)

Robert Koch[17] believes that, in order to master malaria, 1 gramme (15 grains) of quinine should be given to the sufferer from malaria in the afebrile intervals—almost always in the morning hours—until the malarial parasites have disappeared from his blood; then follows an interval of seven days; then again 1 gramme (15 grains) of quinine on each of two successive days; then another seven days' interval: again another two days of drugging with quinine, and so on, for at least two months.

W. J. Buchanan[18] says that the Indian gaol experience has settled that it is possible to daily administer preparations of quinine for many months at a time without the slightest mischief resulting. For the past five years quinine or cinchonodine has been personally administered daily to, on the average, over 1600 prisoners for the four months of the rainy season, and never has a single bad result been met with; even severe cases of quininism are conspicuous only by their rarity. It is needless to say that in spite of Professor Koch's alarmist views on the subject of quinine and hæmoglobinuria, there has not been a single case in personal experience nor has there been found after inquiry such a case since the practice was introduced into the prisons of India.

Patrick Manson[19] observes that the treatment of malaria resolves itself into one word: the use of quinine. Quinine is a specific, and, if the specific is properly applied, in 99 cases out of 100 the patient can be saved from the effects of the parasite. In cases of violent remittent fever and grave cerebral attacks the patient may be vomiting and unable to absorb the drug, or he may be insensible and unable to swallow it. Then 5 or 10 grains of a soluble salt of quinine must be given hypodermically or rather intramuscularly. Death from tetanus following on the hypodermic injection of quinine is caused by the culpable carelessness of the physician who, in ignorance, of course, has used an injection containing the tetanus bacillus.

A certain number of patients appear to have peculiar sensibilities as regards the action of quinine. In some it gives rise to urticaria, in some to peculiar toxic effects, and therefore to some patients it cannot be given at all. In these cases methylene-blue is of service. Professor Koch is one authority for its use. It is given in doses of from 3 to 5 grains three or four times a day. Another and graver accusation against quinine is that it is apt to give rise to hæmoglobinuria. Professor Koch's utterances in regard to this have been somewhat misunderstood. Many people suppose that Koch said that quinine gave rise to—is the cause of virus, as it were, of—hæmoglobinuria. What he did say was that quinine under certain conditions brought on hæmoglobinuric symptoms, and

17 Deut. med. Woch., April 25 and May 3, 1900.
18 Brit. Med. Jour., Sept. 1, 1900.
19 Lancet, July 21, 1900.

what he said is, in personal opinion, true. In consequence of what he has said quinine is looked upon with suspicion, if it be not absolutely tabooed, in some tropical countries. This is unfortunate, for, even if quinine is a danger in certain cases, if it does tend to produce hæmoglobinuria in some cases, it is not a one-hundredth part so dangerous in this respect as the malarial parasite.

M. H. Billet,[20] attached to the military hospital at Constantine Algeria, says that thirteen cases of malarial cachexia more or less pronounced, and consequent upon repeated attacks of intermittent fever of varied type, have been treated with cacodylate of sodium. This drug, following immediately on treatment by quinine, restored the red blood-cells from about 3,500,000 (in cases 2,500,000 per millimetre) to normal, and even above that, viz: to upward of 5,500,000, in the space of from fifteen to twenty days. The number of injections was from five to six, at intervals of three or four days, the dose employed being $3\frac{3}{4}$ grains for each injection. In two or three cases $1\frac{1}{2}$-grain doses were used. The hæmoglobin proportion was raised simultaneously with the increase of red blood-corpuscles from between 9 and 11 per cent. to, progressively, 11, 12, $12\frac{1}{2}$ and $13\frac{1}{2}$ per cent.—or almost normal. The weight likewise followed an ascending progression. This treatment following upon quinine is considered as distinctly restorative from the effects of malarial cachexia.

20 Jour. Amer. Med. Assoc., Aug. 25, 1900.

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. . . SPECIAL ATTENTION . . .

of the Medical Profession is directed to this remarkable Curative Preparation, as it has been endorsed by THOUSANDS OF THE LEADING PHYSICIANS OF THE UNITED STATES, who are using it in their daily practice.

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Georgia Journal of Medicine and Surgery.

EDITED BY

St. J. B. GRAHAM, M. D. W. B. FITCH, M. D.

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HALF-TONE ENGRAVINGS to illustrate accepted articles will be made free of charge, if proper drawings or negatives accompany the manuscript. Electrotypes of such cuts furnished at cost.

PHYSICIANS' WANTS, ETC.—A department will be devoted to the free publication of subscribers' wants, practices for sale, change of location, etc.

SECRETARIES OF MEDICAL SOCIETIES will do us a favor by keeping us informed of dates of meetings same, etc

MALARIA—ITS VARIOUS MANIFESTATIONS AND COMPLICATIONS.

The importance of the subject has justified us in selecting Malaria for special consideration in this issue of the JOURNAL. Malaria, like charity, has been made to "cover a multitude of sins" for which it is not responsible. Indeed, numerous diagnostic blunders have been made in the name of malaria as political crimes have been made in the name of liberty, and still blunders and crimes will continue to be made, no doubt till the end of time. When we take this fact into consideration we are not surprised at some physicians who are always diagnosing malaria.

It is of the utmost importance then in the field of medicine to carefully and thoroughly examine your cases, and if you would be a correct diagnostician supply yourself with a good microscope and become proficient in its use, after which a drop of blood from your patient and a few minutes' work will reveal the presence or absence of the malarial plasmodium. Then your diagnosis is easy. Most medical blunders are made through carelessness rather than ignorance.

In these modern days malaria manifests itself In a less definite way than formerly. Well expressed chill and pronounced fever, with intermission, are much less frequently met with than formerly. The tendency of malaria latterly has been to express itself in a less

distinct way, a hybrid manner as it were, no well defined chill, and often no fever, and frequently in the form of a remittent or low continued fever; hence the frequency now of failure to properly interpret symptoms as those of malaria, or, as too frequently happens, the ill-defined manifestation of other serious diseases are attributed to malaria.

We would urge all practitioners to form the habit of examining the secretions of their patients, and the blood as well, thus becoming more exact in their work. It is well, also, to remember that these examinations must not only be carefully made and the evidence strengthened by repetition, but the results must not be taken alone, and only to be dovetailed, harmonizing with the clinical story, the bedside picture.

In malarial districts we surely do have frequently cases of infection from the Eberth bacillus, plus the plasmodium of Laveran, just as we frequently have the Klebs-Loeffler bacillus infection added to scarlet fever. So, too, we often meet, particularly in Georgia, cases of so-called "bilious remittent fever," running from one to eight weeks, interpreted and treated by some practitioners as typhoid fever, and when so treated they frequently die. Primary free purgation, frequently repeated with heavy doses of quinine, also frequently repeated, is the determining factor here.

We are taught by Osler, Thayer and other competent authorities that quinine is a specific for all the manifestations of malaria. If Dr. Osler and others were to see some of the types and manifestations of malaria witnessed by practitioners in this climate they would change their minds, for we repeatedly see types of the disease in which quinine in no size dose, time or manner of administration has any effect whatever in the course of the fever. It is a fever of a continued type, neither a remittent nor a typhoid.

MALARIA AND THE MOSQUITO THEORY.

We desire to ask attention to Dr. Liell's article in this issue bearing upon the mosquito theory. To us no more interesting fact in the etiology of disease has been discovered than the part the mosquito plays in the transmission of malaria. It has stimulated the study of this disease, which seemed to have ceased after the discovery of the different forms of the plasmodium, and has aroused such scientific enthusiasm as to bring to its investigation many distinguished workers and to make the consideration of tropical diseases of the highest importance.

Many novel experiments have been made in medicine but none more so than the two suggested and carried out by Manson, who first conceived the relation of the mosquito to this disease. One consisted in having mosquitoes, which had fed on a malarial patient in Italy, brought to London and placed so as to bite a healthy individ-

ual free from malaria and thus to develope in this subject malarial fever.

The other, which was the complement, sought to keep Europeans, who had never had malaria, free from malaria in an intensely malarial region, where all the inhabitants and visitors suffered from malaria, simply by avoiding the bite of the mosquito. For the first experiment Manson used his son, who after being bitten by infected mosquitoes had chills, fever as high as 103.6° and sweats. The spleen was palpable on deep inspiration and many tertian parasites were found in the blood.

The other experiment took place in the Roman Campagna near the mouth of the Tiber in a wooden hut constructed in England. The only protection for the inmates was mosquito netting, wire screens in doors and windows and netting about their beds. They went about the country freely in the daytime, avoiding the anopheles quadrimaculatus, and remained in their hut from sunset to sunrise, as this species of mosquito, which is the carrier of the malarial parasite, bites only at this time. During the four months of their stay in this intensely malarial region the experimenters, five in number, enjoyed perfect health and had no sign of malaria.

A recent writer observes:

"The fact that the malarial parasite is paludal in its habits, and that the mosquito is a blood sucker and also paludal in habit, is extremely suggestive of this connection. The idea, however, did not take definite form until Patrick Manson, in his Goulstonian lectures, delivered in 1896, set forth a definite hypothesis, based on certain well-established facts, namely, that the malarial parasite possessed a flagelating phase, that this phase is developed from the mature parasite, that it is evolved only when the parasite is outside the human body, that the flagella, when formed, break away from the parent parasite, and that, when free, the flagella were capable of living as independent organisms. He was thus led to believe that the flagella was the extracorporeal phase in the life history of the parasite. As it was impossible for the latent form in which this organism originated to escape from the human body by itself, it was necessary to invoke the assistance of some outside agency. The most probable agent was the mosquito, and Manson supposed that the flagellated body was sucked, in its latent form, into the stomach of the mosquito and developed therein. The flagella then broke away from the central sphere, and in virtue of their locomotive power traversed the blood in the mosquito's stomach, penetrated the stomach wall, entered some cell and started the "outside-of-the-body" life of the malarial parasite. Manson still believed, however, that malaria could be air or water borne, for he supposed that on the death of the mosquito the parasite was liberated, and either inhaled from the air or carried into the system in drinking water."

MALARIAL FEVER.*

Malarial fever prevails especially where heat, moisture and decomposing vegetation are present because these are favorable to the existence of mosquitos. Malarial infection occurs most commonly after sunset, because mosquitos, after remaining in hiding during the day, set out upon their depredations after dark. The infection is not widely diffused in a horizontal, oblique or vertical direction because mosquitos do not fly far from their place of origin, and especially not to a great height. The infection is not conveyed, but rather hindered, by winds, because the insects do not leave their hiding places when the wind blows. Woods, instead of preventing, may be foci of malarial infection, because the mosquitos make their hiding places in damp woods and trees.

A great advance was made when, in 1880, Laveran, a French army surgeon at Algiers, discovered the parasite of malarial fever, but it was not till fifteen years later that their complete life cycle was demonstrated by Ross, a British army surgeon in India. The observations of Laveran were soon confirmed and elaborated by others, particularly in Italy and America. It has been shown that the malarial parasites are protozoan organisms belonging to the order of sporozoa and, by reason of their living at the expense of the red blood-corpuscles belonging to a special suborder known as hemosporidia. Members of this group, though not necessarily of the same genera and species, have been found in batrachia and reptiles, in birds and in mammals.

For a long time a warm discussion was waged as to whether the parasites were polymorphous varieties of a single organism or so many different and distinct organisms, but the concensus of opinion is at present in favor of the latter view. According to Celli there are in man at least three species: Two for the mild fevers—spring quartan and tertian—and one for the severe or estivo-antumnal fevers—tertian and quotidian. The individual identity of the several varieties of malarial parasites has been demonstrated by inoculations from man to man, the same febrile type only being reproduced in every instance. Of course, mixed infection is impossible, and may give rise to anomalous or atypical forms of fever.

It has been shown that in man, as in birds, the hemosporidin have two life-cycles: an asexual cycle in the blood of malarial animals, and a sexual cycle in the bodies of special mosquitos.

For centuries it has been a popular belief that mosquitos have something to do with malarial fever, and Koch found that a similar notion prevailed among the natives in South Africa. In 1848, Nott, an American, suggested that both yellow fever and malarial fever were conveyed through mosquitos. A similar view was put forward by Allessandrini in 1870, by King in 1883, by Laveran in 1884, by Flügge in 1889, and by Pfeiffer and Koch in 1892. In 1894, and

* Editorial J. A. M. Association, January 19th.

again in 1896, Manson proposed the view that the malarial parasites, in order to maintain their existence, must pass from man to another host, and he concluded that inasmuch as they are incapable of leaving the body through their own efforts and are not extruded in the excreta, they must be removed by some blood-sucking animal, which, he believed, to be a particular species of mosquito. Ross, then, in 1895 and 1897, was able to demonstrate the parasite in the stomach-wall of particular mosquitos fed on malarial blood, and he was able also to convey the parasite through the mosquito to birds and to man. Ross' observations were at once verified and elaborated by Italian investigators and others and the evidence is now so complete that there can be no further doubt as to the part played by mosquitos in the propagation and transference of malaria. If additional confirmatory evidence be wanting it can be found in the development of malarial fever in healthy individuals, in London, inoculated with malarial mosquitos brought from Italy. Further, the disease did not develop in a number of observers who lived during the malarial season in an intensely malarial district of Italy, but merely protected themselves against the bites of mosquitos, while the disease prevailed as usual among others in the same locality but not protected against mosquitos. Not all varieties of mosquitos, however, act as the definitive host of the malarial parasite, of which man is considered the temporary host. It is especially insects of the genus anopheles, and particular anopheles claviger, also called maculipennis, although other varieties are capable of playing the same role. It is not known with certainty whether, apart from the intermediation of man, the malarial parasite may be transmitted from one mosquito directly to another, either from a parent mosquito to its offspring or from the body of a dead mosquito eaten in stagnant water by larvæ.

It may be conceived that certain conditions predispose to malarial infection apart from those that favor the existence of the infecting mosquitos. Chilling of the surface of the body seems to be the most important of these, probably by lowering the bodily resistance. The spring is generally the season for mild cases and the autumn that for severe cases.

Gray's Glycerin Tonic Comp. is uniformly effective, because it duplicates and reinforces nature's methods. This remedy is primarily a stimulant to normal nutritive processes; it begins aright by coaxing atonic, functionless digestive organs to resume their normal work—enables them to digest and assimilate exactly what nature needs—food for blood, tissue and nervous force. It is an invariable effective remedy in anemia, nervous exhaustion and malnutrition from whatever cause.

* *

Write Bovinine Co. for handbook of hæmatherapy; page 1.

EDITORS' TABLE.

We call attention to the following new advertisements, beginning with this issue:

Armour & Co., Chicago.
Auto Chemical Co., St. Louis.
Simon N. Jones & Co., Louisville.
Old Time Distillery & Distributing Co., Louisville.
Parry Manufacturing Co., Indianapolis.
T. B. Wheeler, Montreal, Canada.
Hotel Bartholdi, New York.

* *

We acknowledge, with thanks, the following renewals:

Bovinne Co., New York.
The Maltine Co., New York.
O. D. Chemical Co., New York.
Scott & Bowne, New York.
Mr. Fellows, New York.
J. S. Tyree, Washington.
Fabenfabriken of Elberfeld Co., New York.
McKesson & Robbins, New York.

* *

Scott & Bowne have presented us with their new Twentieth Century Calendar and memorandum for 1901. It is one of the most convenient articles of desk furniture and is a daily reminder of the value of Scott's emulsion as a nutritive and reconstructive agent.

* *

The Unique Card Index System of accounts, case records, therapeutics, advance in surgery and allied sciences is issued by the Technique Publishing Co. of New York. Information concerning it will be supplied upon application to the Company.

* *

The Antikamnia Calendar for 1901 has come to hand. It is issued in four tablets, each sheet containing a calendar for three months and each is illustrated with a skeleton sketch, painted in water colors by the late Dr. L. Crusius. These four are the last of the "sketches" left by Dr. Crusius at his death. They are remarkable specimens of an art that is unique—that of giving life-like facial expression to the human skull.

* *

Messrs. John Wyeth & Bro. have an ideal infant food. They tell you about it on page xvi. Look it up; It's worth your while.

* *

On page xviii you will find several attractive advertisements.

* *

If you want to buy a buggy, or any vehicle, write Parry Manufacturing Co. See advertisement.

* *

Simon N. Jones Co., Louisville, have a spiritual advertisement on bottom of page viii. This will interest you, doctor. It's a good thing, too.

Colden's Liquid Beef Tonic, an ideal liquid food indicated in wasting diseases. Write for a sample and literature.

* *

Write Farbenfabriken of Elberfeld Co. for samples and literature on their valuable preparations. Page xii.

* *

For private sanatoriums see advertisements on page xiii.

* *

The Tilden Co. have an attractive advertisement on page xv.

* *

Physicians going to New York for post graduate instruction would be pleased with Hotel Bartholdi, located near all the post graduate schools. Comfortable, home-like accommodations. Write Mr. Roble. Advertisement on page xv.

* *

Two attractive advertisements on page vii, opposite last page of reading matter—Mr. Fellows' and Scott & Bowne's.

* *

Martin H. Smith & Co. have an advertisement on page viii calling attention to Glyco-Heroin in coughs, phthisis, pneumonia and lagrippe. Write for literature and samples. On page xix they have an attractive advertisement describing a new and efficacious preparation—Ergoapiol—indicated in menstrual irregularities, a preparation we can heartily commend.

* *

The Auto Chemical Co., St. Louis, tell you about the indications for Laxchina in coughs, colds, lagrippe, pneumonia.

* *

Nephrotone for chronic intestinal nephritis. See advertisement and write for literature; page vi.

* *

Celerina is useful in impotency and loss of nerve power. Advertisement on page vi.

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Have you used Cystogen? Do you use Cystogen? Do you expect to use Cystogen? If not, why not? Do not your bladder cases give you trouble?

* *

The way to make the best and cheapest antiseptic used is to dissolve Tyree's antiseptic powder. See advertisement and write for a sample.

* *

For those discouraging cases see page iii, and if you have not used the Maltine preparations you ought to; they are all right.

* *

Pepto-Mangan ("Gude") is the "stuff"—palatable, neutral, organic, hæmoglobinogentic; page iv.

* *

Antiphlogistine, an up-to-date poultice and surgical dressing—anodyne, osmotic, hygroscopic and antiseptic. The Denver Chem. Mnfg. Co.

* *

Before starting on a hurry call toss a bottle of Vitogen in your bag. It's a specific in all cases where antiseptic conditions must be preserved. Advertisement on second page of cover.

NEW BOOKS.

FROM W. B. SAUNDERS & CO.

American Text-Book of Physiology—Edited by William H. Howell, Ph.D., M.D., Professor of Physiology in Johns Hopkins University. Vol. II, royal octavo, of nearly 600 pages, fully illustrated. Cloth, $3.00 net; sheep or half morocco, $3.75 net. Philadelphia and London: W. B. Saunders & Co., 1900.

Even in the short time that has elapsed since the first edition of this work there has been much progress in Physiology, and in this edition the book has been thoroughly revised to keep pace with this progress. The result is that the American Text-Book now represents the most modern work on Physiology. Statements and theories that have been shown to be wrong or improbable have been eliminated, and the new facts discovered and the newer points of view have been incorporated.

The chapter upon the Central Nervous System has been entirely rewritten in the light of the latest knowledge, with the intention of rendering this important branch of the subject suitable to the needs of students and practitioners. A section on Physical Chemistry forms a valuable addition, since these views are taking a large part in current discussion in physiological and medical literature.

The first edition of this work was pronounced to be the best exposition of the present status of the science of Physiology in the English language, and in its revised form the book will doubtless remain the leading work on Physiology for students and practitioners.

The subjects comprised in this volume are: Muscle and Nerves, Irritability of, Contractilty of; Electrical Phenomena of and Chemistry of Central Nervous System; The Physiology and Anatomical Characteristics of the Nerve Cells; Physiology of Groups of Cells; Architecture and Organization of the Central Nervous System; Growth, Changes, Organization and Nutrition of the Central Nervous System; The Special Senses; Vision; Hearing; Smell; Cutaneous and Muscular Sensations; Sleep and Physiology of Special Muscular Mechanics; The Action of Locomotor Mechanisms; Voice and Speech.

Reproduction.—Reproduction in General; The Male and Female Reproductive Organs; The Reproductive Process; Epochs in the Physicial life of the Individual and Heredity.

The collaboration of several teachers in the preparation of a textbook on physiology is unusual. The advantage to follow this method is that the student gains thereby the views of a number of teachers. In other words, he reaps, as it were, the benefit which would be obtained by following courses of instruction under different teachers. In this last respect the book reflects more faithfully, perhaps, than if written by a single author, the legitimate differences of opinion which are held by various teachers at present with regard to certain questions, and more perfectly presents in an unprejudiced style the

existing state of our knowledge, which is an attractive feature of the book. We can commend it most heartily, not only to all students of physiology, but to every physician and pathologist as a valuable and comprehensive work of reference written by men who are eminent authority in their own specialties, who jointly present the best exposition of the present status of the science of physiology in the English language.

FROM E. H. COLEGROVE.

Obstetric Clinic—By Denslow Lewis, Ph.C., M.D., Professor of Gynecology in the Chicago Policlinic; President of the Attending Staff of Cook County Hospital, Chicago; President of the Chicago Medical Examiners' Association; Vice-President of the Illinois State Medical Society; Ex-President of the Physicians' Club of Chicago; Consulting Obstetrician to the Florence Nightingale Home; Senior Gynecologist and Obstetrician to the Lakeside Hospital, Chicago; Late Special Commissioner from the Illinois State Board of Health and the Health Department of Chicago for the Investigation of Municipal Sanitation in European Cities. Octavo, 640 pages. Price, $3.00. E. H. Colegrove, 65 Randolph street, Chicago.

The volume before us for review is a series of thirty-nine clinical lectures on practical obstetrics delivered to students and practitioners in Cook County Hospital, Chicago; together with remarks on criminal abortion, infanticide, illegitimacy, the restriction of venereal diseases, the regulation of prostitution and other medico-sociologic topics.

At the request of many practitioners to have the stenographic reports of lectures delivered at Cook County Hospital compiled in book form, Dr. Lewis reluctantly assented, and when bound a book is presented which is essentially different from anything we have seen on this subject.

The author says "the stenographic reports are submitted practically as they were taken and all intentions to produce a book is disclaimed." Still, it looks like a book to us. It has good cloth binding; looks well and is a real clinic; do you good to read it.

FROM EDWARD R. PELTON.

Rudiments of Modern Electricity, Arranged in the Form of Questions and Answers, Prepared Especially for Students of Medicine. By S. H. Monell, M.D., New York, Professor of Electricity in the International Correspondence Schools; Founder and Chief Instructor of the New York School of Special Electro-Therapeutics; Member of the New York County Medical Society; Member of Kings County Medical Society; Charter Member of the Roentgen Society of the United States; Formerly Editor of the Electro-Therapeutic Department of the Medical Times and Register,

1894-8. 12 mo. About 150 pp. Price, Cloth, $1.00. New York: Edward R. Pelton, No. 19 East Sixteenth Street, 1900.

This little volume is of the Quiz Compend style and very practical. It is especially desirable that medical students should graduate with an unbiased knowledge of the actual facts now known about the rational Therapeutics of Scientific Electric Currents. This volume presents this needed information so condensed as to be readily grasped by the undergraduate. The author has excluded the obsolete and unnecessary, and presents a practical Quiz Compend.

FROM F. A. DAVIS CO.

Students' Edition—A Practical Treatise of Materia Medica and Therapeutics, with special reference to the Clinical Application of Drugs. By John V. Shoemaker, M.D., LL.D., Professor of Materia Medica, Pharmacology, Therapeutics and Clinical Medicine, and Clinical Professor of Diseases of the Skin in the Medico-Chirurgical College of Philadelphia; Physician to the Medico-Chirurgical Hospital; Member of the American Medical Association, of the Pennsylvania and Minnesota State Medical Societies, the American Academy of Medicine, the British Medical Association; Fellow of the Medical Society of London, etc., etc. Fifth Edition. Thoroughly Revised. $6\frac{1}{4} \times 9\frac{1}{2}$ inches. Pages vii–770. Extra Cloth, $4.00 net; Sheep, $4.75 net. F. A. Davis Company, Publishers, 1914–16 Cherry Street, Philadelphia.

The appearance of several repeated editions of Dr. Shoemaker's book in rapid succession (we reviewed the fourth edition in our April, 1900, issue, about eight months ago), gives evidence of its popularity and practibility, and its value in this respect is of the kind that commands respect, the appreciation not only of practitioners, but teachers and students alike.

This edition is a special *students' edition.* The author recognized the special needs of the student for a text-book on materia medica n which nothing is included beyond a description of those drugs and preparations which are officinal in the pharmacopœias of the United States and Great Britain, together with their chemical modifications. The doses are given throughout in the metric system of weights and measures, followed by their equivalent in grains and drachms. There is no doubt but that eventually the metric system will supersede the old system, and the author wisely and timely wishes the student to be trained in its use from the beginning. The rudiments of pharmacology are systematically arranged for convenience of study. First the name of the preparation, and doses follow pharmacology and the physiological action and therapy.

The book will be sought after by students. It is unquestionably one of the best books that has ever been placed before the student body.

The author will soon issue another edition, known as the Physicians' Edition. We urge all progressive men to buy this book and peruse its pages.

FROM D. APPLETON & CO.

Introduction to the Study of Medicine—By G. H. Roger, Professor Extraordinary in the Faculty of Medicine of Paris; Physician to the Hospital Parte–D'Aubervilliers. Authorized Translation by M. S. Gabriel, M.D., with Additions by the Author. D. Appleton & Co., New York. 1901.

The book before us is a very interesting one in many respects. It is a compilation of a series of lectures delivered during 1897–98, at the University of Paris. The faculty, realizing the embarrassment that students are sometimes confronted with in not knowing what books to read or what subject to begin with, requested the author to prepare a course of lectures covering this subject. The author has endeavored to explain in this volume *The Object of Medicine* and by what measures it may be studied, and after explaining how and why an individual becomes sick, takes up the morbific causes which constantly tend to modify the unstable state of health. These causes give rise to manifestations through the lesions and reactions they determine, some of which can only be detected after death. He leads the reader to study the mode of reaction of the organism, pathological physiology, and the organic changes constituting pathological anatomy. The author then devotes 200 pages to the consideration of the examination of the sick, demonstrating that it is possible to make a diagnosis and prognosis by simple means within the reach of every physician. The author is a firm believer in the use of the laboratory as an aid in diagnosis.

The author points out, with emphasis, that it is clinical experience by which we find the indications of proceedures whereby we favorably modify this evolution of disease.

The author, step by step, carries us through the morbid processes, thereby endeavoring to construct a frame in which the descriptions of general or special pathology can be structured.

In closing this all too brief review, we desire to say we have never examined a book with which we were more pleased, and to commend it is both a pleasure and a duty.

FROM E. B. TREAT & CO.

Physical Diagnosis in Obstetrics—A Guide in Antipartum, Partum and Post Partum Examination. By Edward A. Ayers, M.D., Professor of Obstetrics in New York Polyclinic; Attending Physician to Mothers' and Babies' Hospital. With Illustrations. Published by E. B. Treat & Co., 241 and 243 W. 23d St., N. Y. City. Price, cloth, $2.00. 1901.

Among the various branches of medicine obstetrics has made most notable advances during the past decade. The student is no longer graduated without actual knowledge of pregnancy and confinement.

The author being a clinical teacher of obstetrics for eighteen years has realized the need for a book to guide the young practitioner in his obstetric bedside work. Dr. Ayers presents the subject in a very interesting and attractive way, beginning with a printed chart for recording the general and previous history of the patient relating to her present pregnancy, taking up in succession the condition present in the antipartum period leading to the history of labor, the puerperium and care of the child, making a history which becomes an ever-present guide in one's actual work. Following next will be found a chapter on uterometry, pelvimetry and abdominal palpation. Then the subject of vaginal examination is given thorough but concise explanation, and especially the necessity of asepsis in relation to antipartum examinations. Next the urinary organs receive due consideration. History of Labor—In this chapter the author carefully covers the subject—the preparation of patient, vaginal examination during labor, pains, fœtal position, presentation, fœtal heart, sounds, &c. Next is considered complicated pregnancy, instrumental delivery, etc.

The book is a very valuable one and a great aid in diagnosing obstetric complications. We would urge physicians who do obstetric work to buy it.

Do you treat diphtheria? If so, you will be a back number unless you use antitoxin. H. K. Mulford Co. make the best. See advertisement, bottom of second page of cover.

* *

The last page of cover has an attractive advertisement, always reliable. Write them for any information you may desire on their products.

* *

Armour's Supra Renal Capsules—astringent, hemostatic, heart tonic. See advertisement, title page of cover.

* *

New Orleans Polyclinic.—Physicians will find the Polyclinic an excellent means for posting themselves upon modern progress in all branches of medicine and surgery. The specialties are fully taught, particularly laboratory work. Fourteenth annual session opened November 12, 1900. For further information address Dr. Isadore Dyer, Secretary, New Orleans Polyclinic. New Orleans, La.

* *

Notice.—Sander & Sons' Eucalyptol.—Apply to Dr. Sander, Belle Plaine, Iowa, for gratis-supplied sample and literature on Sanders' Eucalyptol. Meyer Bros. Drug Co., St. Louis, Mo., sole agents.

PROGRESS
—OF—
MEDICAL SCIENCE.

THERAPEUTICS

UNDER THE MANAGEMENT OF
RALSTON LATTIMORE, M. D.,
SAVANNAH, GA

TREATMENT OF MALARIA IN THE ROMAN CAMPAGNA.*—A campaign against malaria in the Agro Romano was undertaken at the beginning of this summer by the bureau of hygiene of Rome. Instructions were issued to the resident physicians and special medical officers were dispatched by the bureau to patrol the Campagna, distributing quinine tablets and impressing upon the farm laborers and superintendents the urgent necessity of observing certain simple prophylactic measures. From a translation of the official instructions issued by the bureau (published in The Lancet of July 7, 1900) we take the following directions for treatment in developed cases:

"Primary Attacks.—The administration of quinine in tablets, each containing ½ gramme (grains viiss) of the sulphate should be recommended during the subsidence or at the end of the febrile attack. The quantity administered should be 2 grammes daily for three successive days, and 1 gramme daily for other four days. Tabloids sufficient for a week's treatment are to be given in a small box with appropriate directions to each patient. After the remedy has been suspended for five days, it will be well to follow the directions for relapsing cases, even although there be no return of the fever. Hypodermic injections are to be employed only in exceptional cases. The medical officer is recommended to supervise the treatment of primary æstival infections in which the fever of the first attacks should be suppressed as far as possible, experience having proved the importance of prophylaxsis of early treatment.

"Relapsing Fevers.—The administration of sulphate of quinine should be carried out as follows: After the last febrile attack, or during its decline, 2 grammes of the quinine in four tablets are to be given. The following day the same doses are repeated. During the next five days 1 gramme of sulphate of quinine in two tablets is administered, after which the treatment is to be suspended for a week. The following week the administration is to be resumed, the patient being supplied with the same quantity of quinine as in the first

* Gallard's Med. Jour.

week, and the quantity taken regulated as before. When the fever no longer returns, the daily dose should be reduced by one-half. The administration is then to be again suspended for a week. In the fifth week the same amount is to be given in the same way as in the third week, and so also during the seventh week. As a rule, it is not necessary to continue the administration beyond the seventh week. During the weeks in which the quinine is suspended he may, if he thinks proper, administer 'Bacelli's mixture'* or capsules and tabloids containing iron. For convenience of reference the above rules may be stated in the following tabular form:

TABLES FOR THE ADMINISTRATION OF QUININE.

A—In Primary Malarial Fevers.

(Tabloids of 50 cgm.)

	Tabloids.	Total.
First day (near end of febrile attack)	4	2 gm.
Second day	4	2 gm.
Third day	4	2 gm.
Fourth day	2	1 gm.†
Fifth day	2	1 gm.
Sixth day	2	1 gm.
Seventh day	2	1 gm.

"Suspend the administration for five days, then continue as in Table B.

B—In Relapsing Malarial Fevers.

	Tabloids.	Total.
First day (at end of febrile week)	4	2 gm.
Second day	4	2 gm.
Third day	4	2 gm.
Fourth day	2	1 gm.†
Fifth day	2	1 gm.
Sixth day	2	1 gm.
Seventh day	2	1 gm.

Second week.—Supend quinine; daily observations, etc. (in anæmic persons five tablespoonfuls of "Bacelli's mixture").

Third week.—Repeat treatment as in first week, but if no return of fever reduce dose by one-half.

Fourth week.—Suspend quinine; daily observations (in anæmic cases four tablespoonfuls of "Bacelli's mixture").

Fifth week.—Repeat treatment as in third week, with the same precaution.

Sixth week.—Suspend quinine; observations (in anæmic cases four tablespoonfuls of "Bacelli's mixture").

Seventh week.—Repeat treatment as in fifth week. End of treatment if no return of fever.

* "Bacell's mixture" contains the following ingredients: Sulphate of quinine 3 gm.; tartaric acid. 3 gm.; arseniate of sodium, 5 cgm.; distilled water, 300 gm. The dose for an adult is one tablespoonful.

† If on the fourth day after commencing treatment the fever does not disappear continue with doses of 2 gm. In exceptional cases use hypodermic injections.

"The treatment of the fever, whether primary or secondary, should be commenced according to the scheme laid down, even when the last attack has occurred some days previously. Whenever the fever asserts itself it is best to recommence the treatment as for the first day and to continue according to the rules prescribed. The total dose of quinine should be given within two hours, *i.e.*, at intervals of half-hour, three-quarters of an hour, or one hour, according to the fractions. A glass of water should, if possible, be drunk after every tabloid, acidulated by preference with lemon or vinegar. In children the doses should be reduced in proportion to age.

"Hypodermic and Intravenous Injections.—Hypodermic injections are reserved for cases of intolerance of quinine by the stomach and for cases of pernicious fever. In these cases two hypodermic injections are made, each of 1 gramme of the bi-hydrochlorate of quinine dissolved in 5 grammes of distilled and sterilized water. A large syringe is employed, the lateral regions of the abdomen being chosen and the skin washed with gauze and absolute alcohol. The needle should also be sterilized with absolute alcohol or by boiling in a test tube. The hypodermic solution in sterilized vials, each containing 1 gramme of bi-hydrochlorate, will be supplied to the medical officer. The patient must then be conveyed to the temporary hospital or to the city. In the hospital injections of camphorated oil and caffeine will be made. During the two subsequent days 2 grammes of quinine must be given daily either by injection or by the mouth (one tabloid of ½ gramme every hour). The intravenous injections according to Bacelli's method will be made in extreme cases in the sanitary station hospital. For these injections boiled solutions of neutral hydrochlorate of quinine at a temperature of 40° C. should be employed exclusively in doses of 1 gramme in 10 c.c. of chloride of sodium solution (0.75 per cent.)"—*Medical Record.*

Berberin in Malarial Swelling of the Spleen.—Typaldo Lascarato (Grèce Médicale; Indépendenc Médicale) says that berberin, in addition to its bitter tonic action, has the faculty of causing the elastic fibers of the spleen to contract, especially when that organ is enlarged, in a manner similar to that of ergotin on the muscular fibers of the uterus. This is not entirely free from danger as, if it is not administered with caution, its action may be so severe as to rupture the swollen spleen and cause fatal hemorrhage. But berberin, by rapidly and abruptly contracting the parenchyma of the spleen, drives from it en masse the paludal parasites which swarm in it, toward the general circulation, from which arises a fresh access of pyrexia. The administration has often been known to be followed by a brusque elevation of temperature. Many physicians have on this account considered berberin more harmful than useful. However, the author points out that this action of berberin in driving the parasites from the spleen, which is their place of election, into the general circulation is very favorable to the complete destruction and

disappearance of the paludal miasm from the entire organism. The parasites expelled from the parenchyma of the spleen are spread through the general circulation at a very inopportune period of their evolution, when they engage in a deadly struggle with the phagocytes of the blood, to which they easily succumb. To aid this result, the Italian physicians, who have had considerable experience with this remedy, advise its use almost simultaneously with quinin, which attacks them more rapidly in the blood driven out by the berberin from the spleen. In all cases of swollen spleen, therefore, save those of too old standing or the ultimate result of advanced hypertrophy or degeneration of the organ, berberin is highly commended by the author. It is given in a daily quantity of from 1½ to 15 grs., according to the age of the patient, and always in combination with quinin. A favorite Italian prescription is as follows:

℞ Hydrochlorid of berberin .....gr. xv
Bisulphate of quinin ....gr. viiss

M Sig. To be divided in four powders and one taken every half hour or hour for an adult.—*N. Y. Med. Jour.*

The Life History of the Malarial Parasite.—W. S. Thayer, in a paper read before the County Medical Society, and reported by the Medical News, states that the three methods by which the malarial parasite is suspected of being transmitted are by the air, by drinking water, and by the bite of the mosquito. The evidence points strongly to the latter. In the city of Baltimore malaria is not found, and the anopheles is not present. This is the mosquito which is suspected of carrying the parasite. In the suburbs malaria is found and so is the anopheles. In a town of North Carolina which was practically abandoned by white people on account of malaria, many specimens of the anopheles were found, while the culex, a harmless species, was not found. Eight miles distant from this town the culex was found, but not the anopheles, and the region was free from malaria. There is no positive evidence of any other method of transmission. Cases of spring malaria are considered to be relapses. The work to be done now is to determine the habits of the anopheles mosquito, its presence in given localities, its breeding places, and the best methods of extermination.—*Gaillard's Med. Jour.*

Stamping Out Malaria in Italy.—Professor Grassi, to whom the credit of demonstrating the mosquito conveyance of malaria is largely due, says the Med. Press and Circular, has undertaken the task of stamping out the disease in the south of Italy. He proposes commencing operations on the Mediterranean side of the peninsula below Naples, over an area which covers about 30,000 square miles, with a population estimated at close upon two and a half millions. His scheme comprises the rendering mosquito-proof of all houses by means of wire gauze, and the withdrawal of their owners within the protected houses between sunset and sunrise, not a very easy thing to enforce, by the way. Those already suffering from the disease

will be supplied gratuitously with quinine, and some idea of the magnitude of the undertaking may be gathered from the statement that the cost of the necessary quinine will exceed £20,000 annually. The firm of Bisleri, of Milan, have generously offered to provide this enormous amount free of cost should the enterprise prove a failure. The rules of hygiene are to be enforced where necessary by the aid of the military, but, interesting as is the experiment, we must confess to scant confidence in methods which have to be enforced at the bayonet's point. To educate this large population to the necessity for these drastic measures, on the other hand, is indeed a task from which the boldest might well shrink; moreover, years would be required before any method of instructing this ignorant populace could produce any tangible effect.—*D. & H. Gazette.*

The Treatment of Malarial Disease.—Dr. J. T. Wilson (Virginia Medical Semi-Monthly, August 24) says that small doses of calomel and colocynth should be given as a preliminary purge. He also uses alkalines in the first stages, viz: the acetate, nitrate and bicarbonate of potassium. When the fever has been broken up a good tonic should be given. The author has had good results from the following:

℞ Sulphate of quinine ..... 1½ gr.
Sulphate of strychnine ..... 1-30 gr.
Dried sulphate of iron..... 1 gr.
Arsenical acid..... ..... 1-20 gr.
Powdered rhubarb .... ½ gr.
M.—Make one capsule.
Sig.—Take one three times daily after each meal.

To Banish the Mosquito.—The vastly increased importance to humanity which the mosquito has assumed during the past year renders all that pertains to this pest peculiarly interesting at the present time.

While it is not strictly new or novel, it is still noteworthy as being communicated to the State department in Washington by Consul Plumacher, of Maracaibo, that the ricinus communis or castor-oil plant is so distasteful to the insect that it will remain neither about premises where these trees are planted, nor in apartments where the cut branches, leaves and seeds have been exposed.

Even in cold climates it is said that plants four or five feet in height can be raised from the castor seeds, and under favorable conditions will grow in great profusion. If the personal experience of Consul Plumacher in keeping his household free can be duplicated by each future experimenter, sleepful nights and freedom from malaria may still be within the grasp of all who dwell in regions where the tuneful piper loves to exercise his prerogatives.

The castor plant has already done much for man. If this boon is added, we can well afford to toast it in a large bumper of its own oil.—*Med. Record.*

INTERNAL MEDICINE AND NEUROLOGY.

UNDER THE CHARGE OF

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THE ETIOLOGY OF MALARIA.—From all accounts of the work done in the study of etiolgy of malaria in the past two years, we have reason to expect to see the dictum set up that the mosquito is the only agent in the transmission of malaria. At the recent meeting of the American Medical Association, all the papers in the symposium took cognizance of this, and four of the six dealt directly with the subject. All of these had done some work in this field and all were ready to admit that this "ultra" inference was the most rational one and most in keeping with observed facts in malarial sections. Some years ago a paper appeared in the Monthly by Dr. Battle, of Riverside, Ark., describing a "non-malarial refrigerating ventilator." He stated that the only time they had malaria in the house since the erection of this ventilator was after his wife had closed the screens for some reason, and she was attacked with a fever from which she died. Other members of the family were also taken sick at the time. This experience explains more forcibly than any experiment made, because it was made without reference to the mosquito, and hence without bias. Mosquitos do not rise very high above ground, except in the neighborhood of trees, where they may move up by degrees and where they are sheltered from the sun. They correspond in every behavior to the miasm, i. e., do not travel against the wind, do not rise to high altitudes except along gentle slopes, are abundant in season of miasm, are cleared away by rain, and swarm principally at night; at any rate they shun daylight. Two physicians in a town we recently visited had opposite views regarding the transmission of malaria; the one drank only boilered, filtered and iced tank water, used no netting, and had one or more members of his family in bed all summer; the other drank "pump" water and used screens; no fever occurred in this house.

The early spring malarias are relapses from the previous season; the cases of "ice cream," "watermelon," "puerperal" and "surgical" malaria are simply precipitations of a paroxysm in cases of latent infection. Some of the "pump water" malaria seen by the writer at St. Joseph's Hospital this year were intestinal infections yielding to appropriate treatment for bowel trouble, and no further paroxysms developed though no quinine was given.

The German East African Malaria Commission, as also the Italian writers, consider the matter settled and not open to further discussion. Since the malarial organisms have no mechanism for penetrating vessel walls, and the drinking of dew, ditch and marsh water has in all experiments failed to produce infection, whereas the injection of malarial blood will induce an attack of the disease, and the malarial plasmodium has been found to undergo changes in the anopheles or malarial mosquito, and subsequent exposure to such mosquitos under conditions which excluded all possible outside infection produced malarial attacks, we are forced to the conclusion that this is the sole and only mode of transmission.

This opens up an immense vista of possibilities in the management of malaria. It also imposes a new responsibility upon the practitioners in malarial regions, for, since every case of malarial fever is a possible source of infection for others, means should be adopted to prevent mosquitos feasting on an infected individual from inoculating another patient. This is not a fanciful sketch, as the following case will illustrate: A little girl in a certain Memphis family was taken ill with tertian malaria; the attending physician brought us some of the blood. Twelve days after (seven days for the development in the mosquito and five days for period of incubation) the father had a chill; fourteen days later the sister had a paroxysm. Presumably she occupied the room only after the illness of the father, but the attendent is now out of the city and we could not verify this point.

It also becomes our duty to thoroughly cure our patients and call their attention to the fact that this is to prevent the spread of the disease. The flushing of small bodies of water in which the larvæ of the anopheles are found has also been suggested as a means of preventing malaria. It is strange that the Memphis city health authorities, whose duty it is to prevent the development of diseases, should have thrown a dam across a branch of the bayou just north of St. Joseph's Hospital, making an ideal spot for the development of anopheles. We have been getting our supply there for some weeks.

The practitioners in the great Mississippi Valley should not be the last to take cognizance of the newer study of the etiology of malaria. The profession elsewhere looks to us for light on many questions of this kind, and it behooves us to be up to date.—*Memphis Medical Monthly.*

Prevention of Malarial Fever.—The Liverpool School of Tropical Medicine has just issued a small booklet consisting of instructions to dwellers in malarial countries, which should be of particular interest to Americans, both at home and in their new colonial possessions.

The nature of the disease is first touched upon. Malarial fever or ague is caused by certain minute parasites which obtain access to the corpuscles of the blood, which latter acts as their hosts. The

paroxysms of the disease are due to sudden liberation of spores into the blood fluid. As soon as these spores enter new blood corpuscles, fever ceases and sweating occurs. After a number of attacks a sort of tolerance occurs, but relapses, either spontaneous or due to renewed exposure, are prone to develop, perhaps years after the original infection. Quinia acts as a true bactericide in malaria.

The malarial parasites enter the human blood through the agency of certain species of mosquito. The insect becomes infected from sucking the blood of malarial patients, and the parasites spore within the insects' bodies. The salivary secretion of the mosquito is loaded with spores, and as this secretion is injected into the tissues before the blood is sucked out, inoculation readily occurs. The truth of these statements has been demonstrated with mathematical certainty, both in Italy and India. All original infection must have occurred in this manner. Relapses may be due entirely to persistence of the parasites within the blood cells.

The mosquitos instrumental in this propagation of disease are of a single family—the anopheles—which breed in marshes and stagnant water in general, which accounts for the association of malaria with undrained and swampy lands. They may be distinguished from the culex or ordinary harmless mosquito by the peculiar attitude when at rest, the body being pointed at an almost right angle to the wall, etc. The larvæ of the two species, which live on the water, are also readily distinguished; that of the anopheles floats and wriggles backward when disturbed, while the culex larvæ wriggles to the bottom of the water.

To prevent malaria, then, we must avoid being stung by mosquitos and must also seek to destroy the larvæ and mature insects. Nettings should be used on beds, both at night and during naps in the daytime. There is room to exercise the greatest care in these matters, and by making a conscientious study of the subject of canopies the mosquitos can be practically kept away. Punk sticks may be used during the daytime. Flannel socks should be worn to protect the ankles, as the insects readily sting through cotton wear. As mosquitos may live for months and can hibernate, certain houses and localities abound in old, infected insects. When a person becomes infected he must remember that he is a menace to the community if bitten by mosquitoes, and he must use the same care as uninfected persons in protecting himself.

To destroy mosquitos and larvæ outright we must remember that the anapheles frequent natural pools rather than artificial collections of water. A search for larvæ should be made and all ditches, drains, puddles left by showers, etc., should be filled up or drained or otherwise destroyed, with the use of kerosene temporarily or when the collection of water cannot be done away with. Fresh tar and quicklime are also efficacious. Adult insects should always be killed on the walls with flyflappers. Houses should be built on high and

sloping grounds to avoid stagnant water. Ships in port should be quarantined against the anapheles.—*Medical Review of Reviews.*

Malaria and the Mosquito.—The connection between mosquitos and the prevalence of malarial fever has been definitely worked out by Ross, Manson and others, but the practical value of this demonstration remains to be worked out by the everyday practitioner.

The common, ordinary kind of mosquitos do not produce or serve as carriers of malaria.

Gerald McCarthy, in the Bulletin of the North Carolina Board of Health, tells us, in a very interesting paper, some facts in regard to the life history of the malarial parasite.

The genus culex is the ordinary mosquito that keeps us awake these warm nights, but his cousin (the anopheles) gives us chills and fever at a moment's notice.

They differ especially in the way they bite; the culex takes his nourishment on a dead level, while the anopheles stands on his head, or her head perhaps, in order to get his bill down to a better depth.

Mr. McCarthy says that the parasites of human malaria exist in the blood stream at first in the form of amœboid, motile jelly dots. They grow fast and usually in from one to three days attain full size. They then pass into the spore form as sporocytes and gametocytes. The sporocyte is the asexual form. It at once begins to form a sort of capsule in which appear asexual spores. These spores, according to the species, mature in from one to three days. The capsules then burst, the spores fall into the serum and soon after assume the amœboid form. They move about in the blood serum until they find a red corpuscle to attack. The bursting of the spore sacks and the storming of the blood corpuscles by the new generation of protozoans is correlated to the period of recurrence of the fever, and is the cause of the same.

The gametocytes are the sexual form. They no not undergo any further change in the human body except as they may degenerate and die. They may, in this way, circulate in the blood stream for days and weeks. If a mosquito of the genus anopheles sucks the blood of a person in whose blood stream the gametocytes are circulating, the cysts as soon as they reach the fore crop of the insect burst. The microbe resumes the cycle of its development. Some of the cysts produce male, some female germs. These coalesce, and the result is a new individual or zygote. These grow rapidly, are very active and repel the attacks of the phagocytes of the human blood in which they were borne into the alimentary tract of the insect. The zygotes soon bore through the stomach walls of the mosquito and fix themselves upon the external surface in the form of oval cells of from 8 to 10 micromillimeters in diameter. These cells subdivide much like the egg of a vertebrate, and eventually form a capsule full of small spores—each capsule, when mature, is 60 micro-

millimeters to 80 micromillimeters in diameter, and may contain several thousand spores.

The whole process from the time the gametocyte enters the body of the insect until the spores are formed is about ten to twelve days in summer. It is longer in cooler weather. The sexual spores are motile and move about until they reach the blood stream of the insect.

In this they are carried into the salivary glands. When such a mosquito bites a person she injects into the wound some of the saliva and with it the spores of the protozoan. These once in the human blood stream assume the amœboid form from which we started, and so begins a new cycle.

It may be asked what becomes of gametocytes which do not find their way into the body of an anopheles. They eventually degenerate and are eaten by the plagocytes. The same fate, sooner or later, overtakes the sporophytes in the human blood. If, instead of anopheles, it is culex, which receives the gametocytes, so far as we know, the latter do not develop further, but are digested with the blood in which they are imbedded.

Now a few words as to the classification of the protozoan parasite.

The latest authors make two genera:

I. Hæmamœbidæ.

II. Hæmomenas.

The first genus contains four species. Two of these produce malaria in birds, the other two in man.

Hæmamœba malariæ causes quartan fever.

Hæmamœba vivax causes tertian fever.

Hæmomenas has but one species.

H. præcox (Laverania malariæ of older authors).

It causes pernicious autumn malaria in man.

The life histories about outlined are not based upon theory, but upon microscopic dissections. They are as true as anything can be in science.

He says that drinking water has no part in the etiology of malaria, and that the tearing up of surface soil in hot weather does not produce malaria.

To the statement that malaria cannot be caused by impure water, Dr. Lewis, the Secretary of the Board of Health, takes exception. The fact that impure water may cause malaria has been proved by experience, which knocks out any amount of theory in the first round. But the mosquito should bear an important part of the blame and our efforts should be towards a practical application of this truth.

As a topical application to prevent mosquitos from biting, nothing equals kerosene or coal oil, in our experience. To suspend a small flannel rag, wet in kerosene, at the open window or door will keep them out of the room. Rub some over the hands and arms, and

lightly through the hair, and it will compel a roomful of mosquitos to stand back.—*Charlotte Medical Journal.*

Professor Koch on Malaria.—Professor Koch's final report to the German Foreign Office of his researches on malaria in various parts of the world has been published. Our readers have had an opportunity of studying the facts collected by the distinguished German pathologist, and the views expressed by him on this most important subject. He himself has since his return to Berlin given a summary of them in a public lecture delivered on November 15th at a meeting of the Berlin-Charlottenburg Section of the German Colonial Society. This may be taken as representing Professor Koch's present attitude on the malaria question; we therefore think it will be useful to give an abstract of the lecture. After describing the investigations which he and his colleagues had made in Italy, in Java, and in New Guinea, he went on to say that as the result of these investigations he had come to the conclusion that though the developed parasite, the cause of the fever, was introduced into the human body by gnat bites, yet the permanent home of the parasite germ was in the human body itself. The germs were passed by the gnat from one person to another and were developed in the body of the gnat during the passage. In combating the disease it was therefore necessary to begin with the persons affected and not with the gnats. Children were especially liable to the disease. Professor Koch stated that in New Guinea, in all the places where the disease was prevalent, all the younger children suffered more or less seriously from it. At a village called Stephansort, where 137 inhabitants out of 700 were affected by the fever, they had all been cured by the use of quinine. The new-born infants were made the subject of special attention, and it was found possible to keep them in good health, although it had hitherto been impossible to rear children at Stephansort. Discussing the methods which had been suggested for combating the disease, Professor Koch said that he regarded the proposal to exterminate gnats as impracticable. Mosquito nets were useful, but not absolutely to be relied upon. All attempts to secure immunity from malarial fever by means of inoculation had hitherto failed. Preventive treatment by quinine had great value, but was not always practicable. He urged that the colonial authorities should supply quinine free of charge and that doctors trained in microscopic work should be sent to New Guinea and to German Southwest Africa.—*British Medical Journal.*

GENERAL ORTHOPÆDIAC AND GENITO-URINARY SURGERY.

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THE TREATMENT OF RECTAL CARCINOMA AT THE ROSTOCK CLINIC.—By Dr. F. Schneider (Rostock). This review of 115 cases treated at Rostock during the period of 1883-1899 purposes in the main to show the gain secured by the sacral methods introduced by Kraske in 1887, and thus to offset the adverse contention of English and French surgeons. Sixty-six males and forty-nine females made up the list of the afflicted, the average being 59 for the former, 55 for the latter. Four cases are recorded during the juvenile period, viz., aged 14, 15, 17, and all were examples of cylindrical carcinomata, and their fate that of adults with like carcinomata.

Etiologically, hæmorrhage and prolapse were found responsible factors in the greater number of instances. There were no distinctive rectal signs peculiar to carcinomata, as in most instances digital examination alone cleared up the situation.

Operation.—Whereas Kraske's operation has enlarged the field and scope of operative interference, it has in no measure replaced the older procedures, which are applicable to less extensive carcinomata, and are therefore not competitors with Kraske's method. Concurrent with the latter are Kocher's and Schlange's osteoplastic methods. Against the latter it is held that it offers too small a space, and leaves too many pockets, which favor wound infections. Other procedures, like Rehn's vaginal route or the abdominoperineal route of Quenu and Hartmann, were not practiced. The indication set down for Kocher's method is a growth beginning just above the anus, and whose upper limit can still be palpated, no adherence to the sacrum, and a tumor that can be drawn down. Kraske was reserved for growths so extensive as not to permit of the introduction of the finger into the lumen of the bowel in order to palpate the upper limit of the growth, and where extensive adhesions existed with the sacrum. The performance of methods without bone resection is limited to growths situated no higher than eight to ten centimetres, which must not be circular nor adherent, nor must there be any metastases in the sacral glands. As inoperable are to be regarded cases where the bladder or uterus is invaded, or where infiltrations

are extensive or flat, and where there are metastases of the internal organs. Between these two latter extremes lies the medium for bone resection methods, which embrace by far the majority of operations. The restoration of the rectal canal was favored by end-to-end suture of the sagments, provided the proximal stump was freely movable, and enough of the anal stump was preserved; and be it here stated, that only in exceptional instances could the peritoneal reflection be spared. To ensure accurate adaptation, supplementary sutures were passed through perirectal tissues. This method was practiced in seven out of seventeen cases with success. Where the distal segment was small and the proximal freely movable, invagination of the latter into the former was done; this was executed 31 times successfully. Artificial sacral anus was made seven times, and three times according to the torsion method of Gersuny, and only in one instance, according to the latter method, was continence obtained.

A summary of the results is as follows: Cases operated without bone resection 20, of which 13 died after one year and ten months; 2 died as direct result of the operation; three times was continence obtained. Seven survived three years, and of these two even lived beyond nine years. With bone resection according to Kocher's method, 12 cases were operated, 4 died from complications associated with the operation; of the surviving eight only one lived three and another six years. In no instance was continence obtained. Operated by Kraske's method are 17 cases; 13 survived the operation, 4 died from complications intimately dependent on the operation, 7 died after one year; 5 are living after one year. Kraske's personal experience in the first ten cases offered a mortality of 40 per cent.; later on, with extensive experience in 51 cases, this mortality was reduced to 9.8 per cent.

According to Schlange's temporary bone resection four cases were operated on, with no deaths from the operation; only one patient lived three years thereafter. The thirty-two cases of colostomy had an average life of eight months. Twenty-eight cases treated palliatively lived thirteen months.

In conclusion, it is stated that of the 31 cases treated with bone resection methods 45 per cent. died in one year, 58 per cent. in two years, and the operation mortality was 23 per cent. Notwithstanding this high death rate, the author expresses his belief that with the dexterity pursuant to a larger experience these figures can be reduced as Kraske himself has shown, so that the field for the only operative procedure which accomplishes a radical extirpation of the neoplasm can be greatly extended.—*Beitrage zur klinische Chirurgie*, Band xxvi, Heft 2.—*Annals of Surgery.*

II. The Removal of Movable Rectal Carcinoma by Invaginatio and Ligature.—By Dr. Rheinwald (Stuttgart). In view of the high mortality of the various sacral methods, averaging 18 per cent. with

but 15 per cent. cures to their credit, and only in 15 per cent. of the cases accomplishing absolute continence, Prof. Steinthal has conceived a method directed to minimize these advantages.

As movable carcinomas only ought to be radically removed, the growth is made to prolapse by traction upon it. Into the invaginated section of the bowel a corrugated tube is inserted to prevent its slipping, and an elastic ligature applied in healthy areas towards the anal side of the bowel. The growth is then allowed to separate by sloughing. Three times this was performed: in one instance, the prolapsed tumor was exercised and sutured. The other two cases were treated typically. In all instances absolute continence was maintained in spite of the necessity to split the sphincter posteriorly in order to bring the growth into view. Of two of the cases it is narrated that no recurrence set in after two and a half and four years respectively. Additional advantages claimed are short narcosis, slight loss of blood, no danger of disseminating the cancer cells. One decided drawback seems to be the danger of including a loop of bowel which may have slipped into the prolapsed bowel. Heuck, of Heidelberg, narrates a similar method of operating applicable only in exceptional instances. Likewise Trendelenburg advises preliminary laparotomy, division of the mesorectum, and then invagination. With the aid of these modifications, the author bespeaks a more extended application for this invagination method which speedily, bloodlessly, and safely accomplishes a good result (?)—*Beitrage zur klinische Chirurgie*, Band xxv, Heft 3.—*Annals of Surgery*.

Cutaneous Cancer Cured by Roentgen Rays.—Stenbeck, of Stockholm, in Mittheilungen aus d. Greazebiete d. Med. u. Chir., Bd. VI., No. 3 (Med. Rev. of Rev.), briefly reports a case of chanchroid healed in the above manner, which is claimed by him to be the first of the kind on record. The patient, a woman, aged 72 years, was exhibited before the Swedish Medical Union, the diagnosis of rodent ulcer was made by Professor Berg, and the case referred to the Roentgen Institute.

Daily sessions were begun of ten to twelve minutes' duration, the lamp being held fifteen to twenty cm. from the surface. After four sessions the reaction began, and, after eight or ten exposures profuse suppuration was in evidence, becoming less with time. After thirty-five sessions the ulcers began to look clean and smooth, the epidermal islets were cast off and new epithelial tissue began to form.

The treatment now became vigorous, exposure prolonged to fifteen minutes each at only ten cm. distance. A weak reaction appeared, but the new-formed epidermis was not affected, and it was evident that a complete cure had resulted.

The greatest resistance was naturally offered by the hard wall-like circumference of the ulcers. An entire month was required to overcome it. It decreased in height and width, then broke up into individual segments, which in time completely disappeared.

OBSTETRICS AND GYNÆCOLOGY.

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THE DIAGNOSIS OF ECTOPIC PREGNANCY BEFORE RUPTURE.—The following points are brought out by Dr. J. F. Baldwin as bearing upon the diagnosis of ectopic pregnancy previous to rupture: The patient gives a history usually of several years of sterility; she has perhaps missed a period or two; unusual pains in the pelvis, described as boring, griping or colicky in character, situated usually in the region of an ovary; a more or less irregular hemorrhage may have recently taken place; discharge of pieces of membrane supposed to indicate an abortion. There may or may not be a suspicion of pregnancy. Upon vaginal examination, there will be found upon one side or the other of the uterus, or posterior, a fusiform quite well-defined cystic tumor about the size of a pullet's egg or a little larger; more or less tenderness on pressure, the tumor quite symmetrical in outline and pulsating. When the uterus at the same time is found somewhat enlarged and having the feel of pregnancy, but not enlarged as much as one would expect in a pregnancy of so long continuance as the history indicates, a presumptive diagnosis of tubal pregnancy is warranted, and the matter of an operation should be carefully and without delay considered. As to differential diagnosis, it is not likely that an enlarged and adherent ovary, an old pyosalpinx, a hydrosalpinx, or a small cyst of the broad ligament, unaccompanied by the foregoing points, would be mistaken for an ectopic pregnancy. The writer reports eleven cases diagnosed and operated upon.—*Annals of Gyn. and Ped.*, November. E. N. L.

SOME CONTRAINDICATIONS TO THE INTRAPERITONEAL USE OF NORMAL SALT SOLUTION AFTER ABDOMINAL SECTION.—Dr. F. F. Simpson, in a paper read before the American Association of Obstetricians and Gynecologists, mentioned the following contraindications of peritoneal infusions of normal salt solution following abdominal section: In patients having ascites at the time of operation, such as complicates malignant ovarian and other neoplasms, because the presence of ascites is prima facie evidence of lowered powers of abortion. The

next class embraces the most important case in the whole domain of medicine and surgery, viz.: Those in which sudden perforation of the hollow viscera, as from typhoid ulcer, gangrenous appendix, etc., or of abscess, permitting large doses of effete substances, bacteria and bacterial poisons to flood the peritoneal cavity. Death from peritonitis is due, not to the local lesion, but to the poison that gains entrance to the blood and lymph channels, and thus reaches the vital centres. In the cases that come under observation, the symptoms prove that large doses of poison have been absorbed. Much fluid is found at operation. It is fair to assume, from the symptoms which demand operation, that this fluid is a virulent poison. To do anything to favor its continued absorption would be most irrational, yet this is the action for which peritoneal infusions of normal salt solution are chiefly lauded. In these cases they are as positively contraindicated as the use of fats and oils in phosphorous poisoning. The type of cases alluded to is defined as that which is found soon after one of the hollow viscera, or an abscess, has ruptured and its contents been poured into the free abdominal cavity. Fowler's position is advocated, because the contact surface of peritoneum and poison are lessened thereby, if the lesion be below the umbilicus, and because it has been demonstrated that the pelvic peritoneum absorbs and distributes slowly. As a further means of restoring absorbtion, the writer states that the use of glycerine in the peritoneal cavity of guinea pigs has the effect of causing the osmotic current to flow from the tissues into the peritoneal cavity. As absorption of poison requires the reverse current, it would seem rational that absorptions might be retarded in this way. The hope is expressed that others may investigate this matter and adapt it to the needs of these pitiable cases.—*Annals Gyn. and Ped.*, November. E. N. L.

The Reefing Operation for Movable Kidney.—The following technique is given by Dr. E. W. Andrews, appertaining to the reefing operation for movable kidney:

1. Incision at outer borders of quadratus from twelfth rib to ilium. This is carried through the lumbar fascia and along the edge of quadratus to loose fat about kidney.

2. The muscles are retracted and the fatty capsule split the whole length of the kidney; the two flaps thus formed are pulled outside, and the kidney thus held well up and back. Care should be taken that the lower pouch of this capsule is pulled high up. In cases of great prolapse, the fatty capsule will be found drawn into a long tube like a stocking. It will surprise one who has not tried it to see how nicely it can be reefed by drawing it out of the skin opening, and how well the kidney obeys every pull made in the upward and backward direction. It is expected that Gerota's capsule is included. Five or six inches of this fatty sac can sometimes be drawn up. The kidney will now be seen to lie snugly in the lumbar wound, and yet to rise nd fall in res piration. Probably it will be an inch or more below its

normal place. This is an advantage, because it removes from it the pressure of the liver and enables one to hold the entire organ and not merely its lower pole. The writer states he has had cases of relapse by older methods in which the lower pole was still anchored by any stitches, while the upper end tilted forward and could be felt below the costal arch in front.

3. The broad segments of the fatty capsule and its enclosing, or Gerota's, fascia already drawn outside are now held by the hands of an assistant or by long forceps, while the opening in the muscular wall is closed by a line of mattress stitches; these transfix the fatty capsule. The real support is obtained, however, not by the stitches, which would cut out, but by compression between the muscles.

4. The flaps should now be cut off an inch or two outside the muscle, erected and stitched down, after which the skin can be closed in any simple manner. These wounds seem to belong to a class in which primary healing is easily obtained. The writer concludes by stating that the adipo-cellular capsule and Gerota's capsule are strong enough to hold up a wandering kidney, and that while stitches cannot hold this tissue, pressure between flaps may do so. That nephropexy will often fail in wandering kidney brought about by gastroptosis and enteroptosis. That the interposed fascia has not caused failure of union in any case. That the operation has been tested from one to thirteen months, showing fair results.—*Jour. American Medical Association.*

(In the historical review given, the writer makes no mention of the excellent work done in this field of surgery by Edebohls, of New York, which is to be regretted). E. N. L.

Myomectomy During the Sixth Month of Pregnancy.—A rare case of this character, successfully operated upon by Dr. Dr. E. R. Lewis is reported, the statement being made that to the writer's knowledge no successful case of the kind is on record. The patient, a primipara, aged 27 years, was examined by a number of physicians, her condition seeming to be rapidly growing from bad to worse, and her distress calling for instant action. Myomectomy, as described by Dr. Howard Kelly, was performed November 27th, 1899, the uterus being in the sixth month of pregnancy. The tumor, situated superior and anterior to the tube on the right side, was as large as a large orange. An incision, nine inches in length, was made in the linea alba to allow the extrusion of the entire gravid uterus and its appenddages. A mistake in diagnosis led to the operation, as the tumor was supposed to be occupying the tube and not connected at all with the uterus proper. The child could be felt plainly in motion beneath the thin walls beyond the growth. The question was hurriedly raised as to a complete hysterectomy, but as the operations of that character within the knowledge and experience of the writer had all proved fatal at this advanced stage of pregnancy, it was interdicted, and decision made to incise, over the dense growth, the uterine wall and rapidly hull out the tumor. Bleeding was controlled by deep

sutures, and the uterus closed with interrupted sutures.—*Amer. Jour. of Surg. and Gyn.* E. N. L.

Hernia of the Bladder in the Femoral Ring.—Dr. Lucy Waite reports a rare case of hernia of the bladder occurring through the femoral ring, the patient giving a history of lifting a heavy tub when she felt something suddenly give way in her side, since which time, two weeks, she had been in constant pain and unable to stand up straight. Upon examination a tumor-mass was found protruding from the left femoral ring, exquisitely sensitive, the size of a small hen's egg, hard and somewhat modular. No fluctuation or impulse on coughing; no difference in size in taking the upright position; no constipation or pain during defecation. Vaginal examination proved negative. A tentative diagnosis of either ovarian or omental hernia was made. Examination of the urine showed numerous pus cells. After dissecting upward a small circular flap and with the mass in view and between the fingers it was no easier to make a diagnosis. It was not until a small piece was snipped out, for microscopical examination, and a clear fluid oozed out that the suspicion arose that the hernia was of bladder origin, which was immediately verified by the passage of a small sound. The opening was quickly closed by three linen thread sutures. A slight snip was then made in Gimbernat's ligament, the tumor returned to the abdominal cavity, and the femoral canal closed by catgut sutures.—*Amer. Jour. of Surg. and Gyn.* E. N. L.

Round Ligament Ventro-Suspension of the Uterus.—For restoring and holding in place the retrodisplaced uterus, Dr. D. T. Gilliam has devised the following operation as fulfilling all indications such as utilizing the natural supports of the uterus, insuring a fair amount of mobility, adapting itself to the various functions of the uterus—pregnancy and parturition—and which will be lasting in its results and withal easy of execution. After a median abdominal incision any adhesions are broken up and the uterus brought forward; the round ligament is then seized, a thread carried under it a distance of 1½ inches from the uterus, and the free ends brought out of the abdomen and clamped. After the other ligament is secured in the same way, the rectus muscle is exposed near the lower end of the incision by retracting its sheath. A point about one inch external to the margin of the incision and something over an inch above the pubis is next selected, through perforating forceps, specially devised, are thrust; the thread which surrounds the ligament are placed within its jaws, the forceps withdrawn, and both thread and ligament brought up through the perforated wound in the abdomen. While the ligament is held taut, it is fastened into the wound by a to-and-fro catgut suture passed deeply through the ligament and including the tissues on either side. The median abdominal incision is then closed. Only a small loop of the ligament should be drawn up through the wound.—*Amer. Jour. of Surg. and Gyn.* E. N. L.

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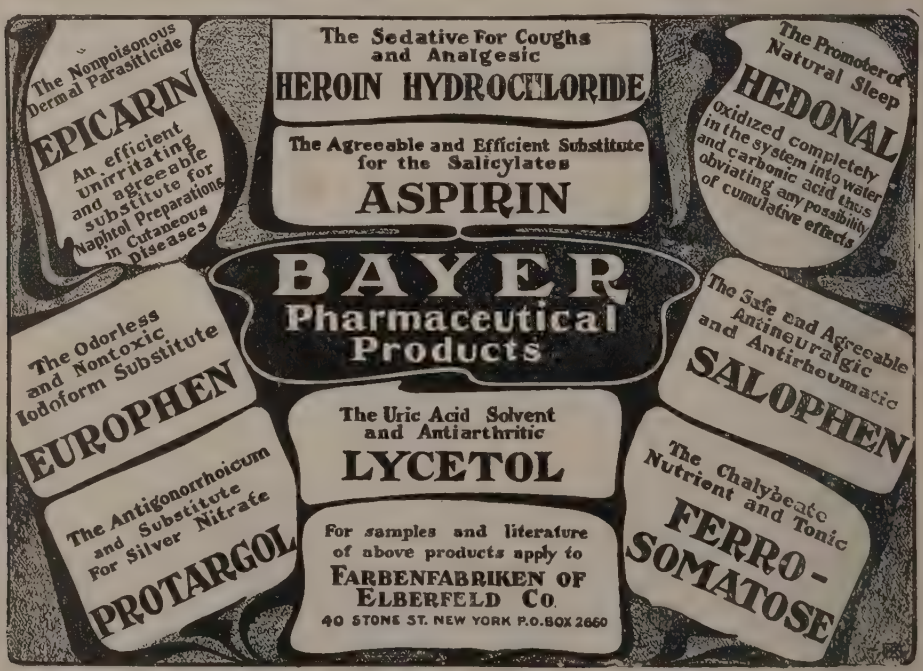
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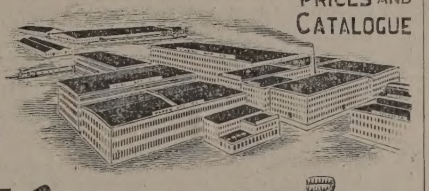

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